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Tampa Electric Company, Big Bend Unit 4

(U.S.) Environmental Protection Agency
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345 Courtland Street
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Tampa Electric Company proposes to construct and operate a 417 MW (NET) capacity coal-fired electric generating plant at the existing Big Bend complex adjacent to Hillsborough Bay in west-central Hillsborough County, Florida. The EIS examines project alternatives, impacts, and mitigative measures related to groundwater, air, surface water, ecological, and socioeconomic and cultural systems.

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Environmental Impact Statement Draft

Tampa Electric Company Big Bend Unit 4

REPRODUCED BY
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U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

JOINT
PUBLIC NOTICE

U.S. Environmental Protection Agency
Region IV, Consolidated Permits Branch
345 Courtland Street, N.E.
Atlanta, Georgia 30365
404/881-7458

in conjunction with

Florida Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301

Public Notice No. PH81FL167 July 16, 1981

NOTICE OF PUBLIC INFORMATION HEARING

ON

DRAFT ENVIRONMENTAL IMPACT STATEMENT; NOTICE OF PROPOSED ISSUANCE OF NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT; NOTICE OF PRELIMINARY DETERMINATIONS REGARDING PREVENTION OF SIGNIFICANT DETERIORATION; TENTATIVE FINDINGS UNDER SECTIONS 316(a) and (b); PROPOSED NET LIMITATIONS FOR SLAG POND EFFLUENT; NOTICE OF CONSIDERATION FOR STATE CERTIFICATION OF THE NPDES PERMIT

A Draft Environmental Impact Statement (EIS) will be made available by the U.S. Environmental Protection Agency (EPA) to the EPA Office of Federal Activities (OFA) and to the public on or about July 17, 1981, on Tampa Electric Company's proposed Big Bend Unit 4 to be constructed near Tampa in Hillsborough County, Florida.

In order to solicit further public participation on the proposed issuance of necessary permits and determinations for the proposed project, a public information hearing will be held. The hearing is scheduled for August 19, 1981, and will begin at 7:30 p.m. at the Ruskin Recreation Center, 901 6th Street SE, Ruskin, Florida. The hearing panel will include representatives from EPA and the State of Florida.

Both oral and written comments will be accepted and a transcript of the proceedings will be made. For the accuracy of the record, written comments are encouraged. The Hearing Officer reserves the right to fix reasonable limits on the time allowed for oral statements.

The U.S. Environmental Protection Agency proposes to issue a National Pollutant Discharge Elimination System (NPDES) Permit to Tampa Electric Company, P.O. Box 111, Tampa, Florida 33601 for its Big Bend Station near North Ruskin Florida, NPDES No. FL0000817. Due to the different administrative procedures required for existing sources (Units 1-3) and new sources (Unit 4), separate applications were submitted and different NPDES Numbers assigned (FL0000817 for Units 1-3 and FL0037044 for Unit 4). However, it is proposed that only one permit be issued for all four Units (FL0000817) after completion of the Environmental Impact Assessment procedures applicable to Unit 4. The application for Units 1-3 describes six existing discharges from the generation of electricity (SIC Code 4911). All six discharges enter the intake or discharge canals which ultimately discharge to Hillsborough Bay. The application for Unit 4 describes an additional six proposed discharges from construction and operation of the Unit into the plant intake or discharge canals. The receiving water is classified as Class III - Recreation - Propagation and Management of Fish and Wildlife - Surface Waters.

Based upon initial evaluations of applicable standards of performance for new sources and Florida Water Quality Standards requirements, EPA notified the Applicant that offstream cooling would be required for Unit 4. The Applicant requested consideration of alternative (once-through cooling) effluent limitations for the thermal component of the discharge under Section 316(a) of the CWA in accordance with 40 CFR 122.53(i). In support of that request, the Applicant submitted biological and engineering data. Review of the data by EPA, the State of Florida and other federal agencies has lead to the formulation of Tentative Findings and Determinations which would allow once-through cooling for Unit 4 (in addition to Units 1-3 which are presently on once-through cooling) under Section 316(a) of the CWA. Tentative determinations also indicate that fine mesh screens as proposed by the Applicant for Units 3 and 4 will be necessary to meet the requirements of Section 316(b).

The Applicant has requested that effluent limitations for total suspended solids (TSS) from the slag pond serving Units 1-3 be applied on a net basis under provisions of 40 CFR 122.63(h). A demonstration has been submitted by the Applicant which indicates that TSS present in the plant intake water are passed through the slag pond and exceed effluent limitations (40 CFR 423.12(b)(4)). EPA, in coordination with the State of Florida, has tentatively determined that effluent limitations for the slag pond may be based on a net basis.

The proposed NPDES permit contains limitations on the amounts of pollutants allowed to be discharged and was drafted in accordance with the provisions of the Clean Water Act (CWA, 33 U.S.C. Section 1251 et seq.) and other lawful standards and regulations. The pollutant limitations and other permit conditions are tentative and open to comment from the public both in writing and at the public hearing.

Fact sheets which outline the applicant's existing and proposed discharge(s) and EPA's proposed pollutant limitations and conditions are available by writing or calling the EPA. A copy of the draft permits is also available from EPA. The administrative record, including the applications, draft permits, fact sheet, tentative determinations, environmental impact statement, comments received, and other information are available for review and copying at 345 Courtland Street, 2nd floor, Atlanta, Georgia, between the hours of 8:15am and 4:30pm, Monday through Friday. A copying machine is available for public use at a charge of 20¢ per page.

The EPA proposes to issue a PSD permit, number PSD-FL-040, under the rules for the Prevention of Significant Deterioration of air quality, 40 CFR 52.21. A public notice on the PSD permit was originally released on December 31, 1980 and is renoticed in this public notice. A copy of the revised preliminary determination is included as an appendix to the Draft EIS.

Persons wishing to comment upon or object to the Draft Environmental Impact Statement, the preliminary determinations under the Prevention of Significant Deterioration (PSD), NPDES permit issuance (including tentative determinations), the proposed permit limitations and conditions, or the State Certification of the NPDES permit are invited to respond in writing by September 2, 1981, to the U. S. Environmental Protection Agency, 345 Courtland Street, NE, Atlanta, Georgia 30365, ATTENTION: Mr. John E. Hagan, III; Chief, EIS Branch. The NPDES numbers, FL0000817 and/or FL0037044 should be included on the first page of comments. All comments received by September 2, 1981, will be considered in the formulation of final determinations regarding the Final EIS, the NPDES permit, permit conditions and determinations, the PSD permit, and the State Certification of the NPDES permit.

A Final EIS will be published after the close of the public comment period. The Final EIS will consist of a summary of the Draft EIS, the Agency's decision on this project, responses to comments received on the Draft EIS, the transcript of the public hearing, and any other relevant information or evaluations developed after publication of the Draft EIS. A copy of the Draft EIS should be retained if a complete evaluation of the project is desired.

After consideration of all written comments and of the requirements and policies in the CWA and appropriate regulations, the EPA Regional Administrator will make determinations regarding permit issuance. If the determinations are substantially unchanged from those announced by this notice, the EPA Regional Administrator will so notify all persons submitting written comments. If the determinations are substantially changed, the EPA Regional Administrator will issue a public notice indicating the revised determinations. Requests for an evidentiary hearing may be filed after the Regional Administrator makes the above-described determinations. Additional information regarding evidentiary hearings is available in 40 CFR Subpart E, 45 FR 33498 (May 19, 1980), or by contacting the Legal Branch at the address above or at 404/881-3506.

The Florida Department of Environmental Regulation has been requested to certify the discharges(s) in accordance with the provisions of Section 401 of the CWA (33 U.S.C. Section 1251 *et seq*.). Comments on issuance of certification must be submitted to the state agency address above within thirty (30) days of the the date of this public notice. The state agency will co-chair the hearing in order to receive comments relative to state certification.

Copies of the Draft EIS, which includes the draft NPDES permits and permit rationale, tentative 316 (a) and (b) determinations, and preliminary determination for the PSD are available for review at the following locations:

St. Petersburg Public Library 3745 9th Avenue, North	St. Petersburg
St. Petersburg Municipal Reference Library, 175 5th Street, North	St. Petersburg
Tampa-Hillsborough County Public Library, 900 North Ashley	Tampa
University of Tampa 401 W. Kennedy Boulevard	Tampa
Manatee County Library System 417 12th street, West	Bradenton
Bradenton Public Library 1405 Fourth Avenue, West	Bradenton
Clearwater Public Library 100 North Osceola Avenue	Clearwater
St. Petersburg Junior College 6605 Fifth Avenue North	St. Petersburg
Sarsota Public Library 701 Plaza de Santo Domingo	Sarsota
Hillsborough Community College Palm & 15th Street	Tampa
University of South Florida 4204 E. Fowler Avenue	Tampa
University of South Florida (Bay Campus) 830 First Street, South	St. Petersburg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

EPA 904/9-81-070
NPDES Application Number:
FL 0037044

Draft
Environmental Impact Statement

for
Proposed Issuance of a New Source National
Pollutant Discharge Elimination System Permit

to
Tampa Electric Company
Big Bend Unit 4
Hillsborough County, Florida

Prepared by:
U.S. Environmental Protection Agency
Region IV, Atlanta, Georgia 30365

Cooperating Agency:
U.S. Army Corps of Engineers
Jacksonville District
Jacksonville, Florida 32201

Tampa Electric Company proposes to construct and operate a 417 MW (net) capacity coal-fired electric generating plant at the existing Big Bend complex adjacent to Hillsborough Bay in west-central Hillsborough County, Florida. The EIS examines project alternatives, impacts, and mitigative measures related to groundwater, air, surface water, ecological, and socioeconomic and cultural systems.

Comments will be received until SEP 2 1981

Comments or inquiries should be directed to:

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Approved by

Rebecca W. Hanmer
Rebecca W. Hanmer
Regional Administrator

JUN 2 5 1981
Date

Executive Summary
for
Environmental Impact Statement

Big Bend Unit 4
Tampa Electric Company

(X) Draft
( ) Final

U.S. Environmental Protection Agency, Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

1. Type of Action: Administrative (X) Legislative ( )

2. Description of Action

Tampa Electric Company (TECO) is proposing to construct and operate a 417 MW (net) capacity coal-fired steam electric generating plant at the existing Big Bend complex in Hillsborough County, Florida. The EPA Region IV Administrator has declared the proposed plant to be a new source as defined by Section 306 of the Clean Water Act. Operation of Big Bend Unit 4 would require a National Pollutant Discharge Elimination System (NPDES) permit. Issuance of this permit would be a major Federal action significantly affecting the quality of the human environment and subject to the provisions of the National Environment Policy Act (NEPA). Consequently, an Environmental Impact Statement (EIS) has been prepared.

As a public utility TECO is obligated to efficiently provide adequate electric power to its service area customers. TECO has conducted an evaluation of its ability to fulfill future electric power commitments and has determined the addition of a generating unit is essential to meeting projected future demands. TECO's forecasted growth rate assumes the Public Service Commission's conservation goals of reductions in peakload and energy usage will be achieved. Accounting for conservation, a reserve margin of 13% would result in the winter of 1985/1986 without Big Bend Unit 4. Firm commitments for the purchase of power at an economically competitive rate have been studied and have been determined not to be cost and time effective (see Appendix G). There is a high probability that the forecasted load could not be served when outages occur or maintenance is required.

Based on testimony and evidence entered during the proceedings conducted on the need for Big Bend Unit 4, the Florida Public Service Commission (FPSC) concluded that operation of Unit 4 as planned (1985) is essential to avoid seriously jeopardizing future service to TECO customers. The FPSC concluded that the cost benefit economics of constructing Big Bend Unit 4 have been demonstrated and the "need" for Big Bend Unit 4 should be certified (see Appendix G).

Additionally, the FPSC stated that evidence suggests substantial socioeconomic benefits could be realized should the coal-fired unit displace oil-fired generation. Approximately 3.9 million barrels of oil could be displaced annually by Big Bend Unit 4. This could reduce Florida's dependence on imported oil by $232 million (1980 dollars) (see Appendix G).

The proposed Unit 4 and supporting facilities would be located on approximately 230 acres at TECO's 1675 acre Big Bend complex adjacent to the Tampa Bay system on the eastern shore of Hillsborough Bay in west-central Hillsborough County. The City of Ruskin is approximately 5 miles south of the complex and Tampa is approximately 12 miles to the north. TECO currently operates 3 coal-fired generating units totaling 1336 MW at the complex. Unit 4 would be constructed directly adjacent to the existing units and would be operational for approximately 30 years.

Major buildings and structures that would comprise Big Bend Unit 4 are the turbine hall and boiler complex, electrostatic precipitators, flue-gas-desulfurization (FGD) facilities, FGD by-product handling and storage facilities, and condenser cooling water intake and discharge structures. The unit is designed to share certain facilities with the existing units including a stack, transmission towers, coal unloading and handling facility, and an existing percolation/evaporation wastewater pond and spray-irrigation field. Stack gases would be exhausted via the Unit 3 stack which was designed to accommodate 2 units.

The Unit 4 turbine boiler, precipitator, limestone storage and handling, and FGD systems would occupy approximately 7 acres. Approximately 7 additional acres would be committed for the coal reserve and service facilities associated with Unit 4. Another 121 acres would be used for an ash settling pond system (fly-ash and bottom ash) and approximately 97 acres for an FGD storage/disposal area. The wastewater treatment system occupies about 40 acres and would not require enlargement.

Makeup cooling water for Unit 4 would be drawn from the existing intake canal for Units 1, 2, and 3. These units currently utilize once-through cooling for waste heat rejection. The intake structures are equipped with conventional screens. Unit 4 would be equipped and Unit 3 would be retrofitted with fine mesh screens (0.5 mm) to reduce the entrainment and impingement losses of marine organisms associated with withdrawing the tremendous quantities of water needed for cooling purposes.

Approximately 347 million gallons per day of Hillsborough Bay water would be required for Unit 4 cooling purposes. An additional 2.1 million gallons per day of freshwater would be required for inplant uses. TECO would obtain the freshwater from the Hillsborough County water system.

Approximately 347 million gallons per day of heated water would be discharged into the existing discharge canal for Unit 4. Other wastewaters (inplant waste streams, fly ash sluicing system blowdown, coal pile runoff, sanitary wastes) would be directed to the existing wastewater treatment system and recycled or disposed of by land application. Several wastes including boiler blowdown, FGD system blowdown, bottom ash sluicing system blowdown, condenser biocide additions, and yard drainage would discharge into the discharge canal.

Unit 4 would burn approximately 950,000 tons of medium-sulfur bituminous coal per year. Fuel would be delivered by covered barges using the existing handling facilities. Coal pretreatment, boiler design features, and air pollution control devices would combine to ensure that operation of the proposed unit complies with applicable air quality regulations. Particulate matter would be controlled with electrostatic precipitators. Sulfur dioxide emissions would be minimized by coal washing and tail-gas scrubbing using an FGD system. The formation of nitrogen oxides and carbon monoxide during combustion would be inhibited by the design and proper operation of the proposed boiler, furnace, and combustion air control system.

Bottom ash, pyrites removed from the coal prior to combustion, economizer ash, and fly ash would be collected and sluiced to settling ponds; subsequently, the dewatered waste material would be disposed of onsite in disposal cells. Fly ash would be available for sale as future markets allow. High-quality gypsum (calcium sulfate) generated as a byproduct of the FGD system would be handled and stored onsite. The storage of this byproduct would be either short or long term depending on its marketability. Permanent disposal would include onsite landfilling of the residual material.

Transmission facilities to accommodate Unit 4 would be limited to installation of a new transmission circuit. No offsite transmission facilities would be required.

3. Major Alternatives Considered

A. Management alternatives (conservation, purchases of power, reactivating and uprating older units, and joint projects)

Alternatives were evaluated primarily with regard to meeting TECO's forecasted demands. The FPSC concluded that should their conservation goals be attained Big Bend Unit 4 would not be needed from a peninsular standpoint. However, if the goals were not attained additional peninsular generating capacity may be needed. For the TECO service area, the FPSC concluded that Big Bend Unit 4 or an equivalent in generating capacity would be needed by 1985 despite TECO's achievement of the FPSC's goals.

TECO does not have any retired units and uprating of existing units would not produce the amount of generating capacity needed. The FPSC concluded that firm purchases of power from other Florida utilities, the Tennessee Valley Authority, and other out-of-state utilities are not cost or time effective on the basis of economics considered (see Appendix G). Despite this conclusion, TECO will continue to seek purchase contracts that are favorable to ratepayers.

B Energy source alternatives (nuclear, oil, gas, coal, hydroelectric, solar)

Major consideration was directed toward the state of the art of these technologies, fuel availability, application to the siting region, and construction time constraints. The proposed coal-fired unit was selected as desirable based on environmental considerations (in conjunction with siting alternatives), available technology, national fuel use policies, and engineering, licensing, and construction lead times. Hydroelectric facilities of the capacity needed lack the requisite geological conditions in Florida, and the Powerplant and Industrial Fuel Act of 1978 generally prohibits the use of petroleum as the fuel source for power plants. Nuclear based generating plants require extremely long lead times for licensing and construction. Additionally, the Big Bend complex is located very near the Tampa-St. Petersburg metropolitan area. Lastly, the nuclear alternative would be more appropriate for a much larger sized unit than the 417 MW facility planned.

C. Siting Alternatives

A detailed siting analysis was performed to identify potential sites and to assess their environmental and engineering suitability for a 417 MW coal-fired facility. An initial screening yielded 13 candidate sites which were further evaluated on more specific environmental and engineering criteria. From this process 3 prime sites were identified (Big Bend, Peace Creek, Highland). Due to the existance of 3 units at Big Bend and potential reservations regarding water availability for cooling requirements at the other sites, Big Bend was selected as the preferred site for the proposed power plant.

D. Cooling System Alternatives

Cooling alternatives evaluated included once-through cooling with conventional and fine mesh screens, cooling towers, and cooling ponds. Cooling water sources considered included Hillsborough Bay, saline groundwater, freshwater (groundwater and surface water), and treated municipal wastewater.

Cooling system evaluation was a major issue in the NEPA process. Prior to commencement of the EIS, EPA Region IV had found that operation of Units 1, 2, and 3 was entraining significantly great numbers of eggs and larvae of fish and shellfish so as to adversely effect the aquatic ecosystem of Hillsborough Bay. Subsequently, modifications to the conventional once-through systems (shutting off the dilution pumps) were instituted to reduce the entrainment impacts. These impacts were reduced by approximately 36% with no substantial and unacceptable thermal impact on the aquatic resources of Hillsborough Bay.

Use of Hillsborough Bay as a source of cooling water in conjunction with conventional screens on the once-through cooling intake structure was judged to be an unacceptable alternative for Unit 4 because the entrainment and impingement losses for Units 1-4 would be potentially adverse.

EPA's tentative determination is that once-through cooling with fine mesh screens on the Units 3 and 4 intake structures would not result in unacceptable adverse entrainment impacts from the Big Bend complex. EPA tentatively has determined that thermal impacts to be associated with operation of Units 1-4 would not cause an unacceptable adverse impact.

The other major cooling system alternative considered was a cooling tower for Unit 4. With this alternative, entrainment impacts and thermal impacts would be less severe. However, salt drift associated with operation of the cooling tower could potentially cause an adverse impact on the agricultural industry adjacent to the complex. A mechancial draft cooling tower would cost $40 million more than the fine mesh screen option.

Cooling ponds are not a viable alternative since the required land is unavailable at the Big Bend complex and at other sites. Use of freshwater for cooling purposes is inconsistent with the water management policies of the Southwest Florida Water Management District. Freshwater is becoming a critical resource in Florida and provisions for its distribution and utilization are structured toward more essential needs.

A potential source of cooling water considered in the analysis was that of treated municipal wastewater. Because the water would need to be transported in a pipeline for approximately 6 miles, it was judged to be a less viable alternative economically and potentially environmentally (cooling towers would be needed) than the once-through cooling with fine mesh screens alternative. There would be no entrainment/impingement impacts associated with this alternative.

E. Wastewater treatment alternatives

Wastewater treatment and discharge systems were evaluated to assess meeting regulatory requirements and to maximize reuse of water. The wastewater treatment system currently in operation at the Big Bend complex is sized to accommodate wastewater from Unit 4. Alternatives to the neutralization, recycling, land application system in use include reverse osmosis and precipitation of metal containing wastes prior to discharge. However, because the ambient water quality levels in the Tampa Bay system already exceed water quality standards these were not considered viable alternatives.

F. Air emissions control alternatives

Air emissions control system alternatives were evaluated considering the state of the art of emission control technology, environmental impacts, and economics. Major sulfur dioxide (SO_2) control alternatives included coal beneficiation and several FGD options. Major particulate control alternatives included wet scrubbers, fabric filters, mechanical collectors, and electrostatic precipitators. Nitrogen oxides (NO_x) control alternatives included application of various combustion technology strategies.

TECO proposes to utilize a lime/limestone scrubbing system to control SO_2, an electrostatic precipitator to control particulates, and an off-stoichiometric combustion boiler to control NO_x. A Prevention of Significant Deterioration (PSD) permit application has been submitted and EPA's preliminary determination on issuance of this permit is appended to the Draft EIS.

G. Residual waste disposal

Alternatives for flyash and FGD sludge focused on marketing the waste and on onsite disposal. TECO proposes to market the flyash and FGD byproduct. Provisions have been made to dispose of the residual wastes onsite if suitable markets become unavailable.

H. No-action alternative

A no-action alternative was evaluated to consider the effects and implications of not issuing an NPDES permit to TECO for Unit 4. Based on the FPSC analysis, construction of Unit 4 is essential to meeting projected electrical demands in the TECO service area. Without Unit 4, TECO's reserve capacity after 1985 would be insufficient to ensure adequate generating capability during outages or scheduled maintenances.

An option available to TECO should an NPDES permit not be issued is purchase of power. The FPSC has stated that purchase of power contracts with Florida and out-of-state utilities have been investigated by TECO. Florida Power Corporation (FPC) and Florida Power and Light (FPL) have no available capacity from their certified units. Further, efforts to obtain capacity from other utilities have been determined not to be cost or time effective on the basis of the economics considered (see Appendix G).

Environmental impacts associated with ground clearing and loss of land use to the plant facilities and residual disposal areas would not occur if the facility were not permitted and constructed. Air emissions in the Tampa Bay area would not increase as a result of the Big Bend complex. Additionally, an increase in the thermal impact from the Big Bend complex to the adjacent aquatic ecosystem would not occur. Loss of aquatic organisms by entrainment/impingement would not be effected by the no-action alternative since use of fine mesh screens on Units 3 and 4 would approximate losses currently noted for Units 1, 2, and 3.

An economic benefit to the Florida peninsular system would also not be realized if Big Bend Unit 4 were not constructed. The FPSC has evaluated evidence submitted during the need for power proceedings and has stated in their Order (see Appendix G) that based on the difference between coal and oil generation costs, an approximate savings of $232 million (1980 dollars) could be realized by construction and operation of Unit 4.

I. EPA's Environmentally Preferred Alternative And Recommended Action

From a pure environmental perspective not constructing Big Bend Unit 4 would apparently be preferable. Based upon the FPSC's findings there is apparently sufficient generating capacity available in the Florida peninsular grid so that construction of Big Bend Unit 4 would be unnecessary. However, in order to meet future TECO service area demands TECO would be required to purchase power from other utilities. Because the two major Florida utilities (FPC and FPL) have no available capacity from their certified units, purchase of power from out-of-state utilities would likely be necessary. The FPSC has stated that on the basis of the economics considered this option would not be cost or time effective. Additionally, the FPSC has stated that substantial socioeconomic benefits could be realized through displacement of foreign oil if Unit 4 were constructed.

When the economic findings as stated in the FPSC Order (Appendix G) are considered, other aspects become significant from a permit issuance standpoint. Consequently, based upon the positive need for power findings of the FPSC and EPA's evaluation of the impacts of the proposed project and alternatives, EPA finds the project alternative proposed by TECO to be environmentally acceptable.

As defined in preceding paragraphs, this alternative specifies constructing a 417 MW facility at the Big Bend complex. A once-through cooling system with fine mesh screens on the Units 3 and 4 intake structures would be employed. Hillsborough Bay would serve as the source of cooling water. Air emissions control technology includes electrostatic precipitators for particulates, flue-gas desulfurization (FGD) for SO_2, and boiler design for NO_x.

EPA tentatively proposes to issue an NPDES permit to Tampa Electric Company for Big Bend Unit 4 as proposed and as described in the Draft EIS. Several measures to mitigate environmental impacts of the project (in addition to those incorporated in the proposed project) have been identified during the NEPA process and have been included as Part III conditions to the NPDES permit. These measures are identified in the Mitigation Measures section of the Executive Summary (Section 5).

4. Summary of Major Environmental Impacts of the Proposed Project

The impacts associated with the facility would be a consequence of the collective interaction of the various system alternatives (fuel source, site, cooling system, air emissions control, residual waste disposal, wastewater treatment) identified with the proposed project. The primary emphasis of the assessment of alternatives focused on identifying the nature and degree of the associated impact and determining means to minimize adverse impacts.

Construction

The direct effect of constructing Unit 4 and attendant facilities would be a commitment of 230 acres of land at the complex. An additional 40 acres would be effected by construction related activities. This land has been disturbed during construction of Units 1, 2, and 3 and is presently described as pasture and agricultural land. As a result, wildlife in these areas would be forced to relocate or more likely would be lost. This is not considered a major impact since the area is not a locally important habitat and has been disturbed in the past.

Jackson Branch which presently traverses the area proposed for use as bottom and fly-ash disposal ponds would be relocated east and north of these ponds. Approximately 2400 feet of channel would be filled and 2900 feet of new channel would be constructed. Because Jackson Branch is an intermittent stream minimal adverse impacts are anticipated from this activity.

Approximately 1110 cubic yards of silt and sand would be dredged from the existing intake and discharge canals during placement of the intake and discharge structures. Construction activities would be scheduled to avoid potential impacts to the manatee. Sedimentation prevention measures (silt barriers) have been included in the proposed project to reduce impacts to the aquatic system during dredging operations. The Corps of Engineers is preparing to issue a dredge and fill permit to TECO for construction of the intake and discharge structures pending completion of the environmental review process.

No point source discharges of construction or site runoff to waters of the United States is anticipated during the construction phase. This objective would be achieved through implementation of an erosion control program. However, there would be a discharge of dewatering wastes to both the intake and discharge canals during construction.

Air quality would be effected by fugitive dust (particulates) during heavy construction activities. Dust suppression controls would be utilized to minimize these impacts. Additional air quality impacts can be expected from vehicle emissions associated with commuting of the construction force.

The majority (90%) of the peak work force (580 workers) is expected to be from the Tampa area. Consequently, an inmigration to the Tampa area of 58 workers and their families is anticipated. No major impacts on housing or public services are expected. Increased vehicular traffic in the vicinity of the complex is anticipated but should not present a traffic control concern. Acoustics impacts should be minimal and would be associated primarily with setting of the steam valves.

Operation

Impacts of operations of Big Bend 4 would primarily effect air resources, the groundwater regime, and the aquatic environment of the Tampa Bay system.

Approximately 347 million gallons per day of Hillsborough Bay water would be required for Unit 4 cooling purposes. This would increase the total Big Bend cooling water requirements to 1388 million gallons per day. The entrainment impacts associated with withdrawing these quantities of bay water are anticipated to be approximately equal to the impacts currently associated with operation of Units 1, 2, and 3. TECO tested a prototype of a fine mesh screened intake structure during a 1980 study program approved by EPA. The results of this program indicated that fine mesh screens appeared to be 56% effective in screening eggs and larvae from the source water. Fish eggs and invertebrate larvae (drum and stone crab) collected from the fine mesh screen were subject to a low level of mortality. Since Units 3 & 4 would use fine mesh screens to reduce entrainment mortality at the Big Bend complex, EPA concluded that fine mesh screening of the intake structures would be a viable technology to minimize entrainment effects. Suggested changes in the design of the intake system and organism return system would be a means to improve the screening technology and decrease organism mortality.

The addition of Big Bend 4 would increase the heat load to the bay by 33% because of the greater volumes of heated water discharged from the complex. At 100% load (Units 1-4) the surface area of the Tampa Bay system enclosed by the 1° C (1.8° F) isotherm at any one time would total 3623 acres (1449 ha) and that by the 5° C (9° F) isotherm would total 380 acres (150 ha). This represents a 2% increase in the area enclosed by the 1° C isotherm and a 54% increase in the area enclosed by the 5° C isotherm. An enlargement of the benthic area presently adversely impacted by Units 1, 2, and 3 is expected. This area would increase from 114 acres (46 ha) to 132 acres (54 ha). EPA tentatively has determined that this does not represent an unacceptable adverse impact to the benthos of the Tampa Bay system.

Certain process wastewaters (boiler, bottom ash, and FGD system blowdowns) would be discharged to the Tampa Bay system. Because ambient levels of several metals in the bay water and intake canal exceed Florida Water Quality Standards, discharge of these wastes would violate the standards. TECO is pursuing a variance to the standards and has indicated that there would be no analytically detectable increase in the levels of these metals in the discharge canal as a result of the operations of Unit 4. Consequently, no significant impacts are anticipated.

Chlorine is to be used to prevent biofouling of condenser tubes and would be discharged at maximum levels of 0.2 mg/l (expressed as total residual oxidants, TRO). Detailed die-away studies are to be conducted prior to the Final EIS to assure a 0.01 mg/l TRO level can be achieved in the 6.1 acre discharge canal.

Impacts to the groundwater regime could occur in the form of leachate from the bottom ash and FGD disposal areas, wastewater pond, spray irrigation field, and coal pile. Primary constituents of the leachate would include acidity, trace metals, and dissolved solids. Movement of leachate would be toward the Tampa Bay system due to natural groundwater flow. Because of the existing groundwater quality and Tampa Bay water quality, adverse impacts to the area are expected to be minimal.

Associated with the spray irrigation system, a groundwater mound would form under the TECO complex. Approximately 0.4 gallons per minute of seepage to the Floridan aquifer is anticipated.

Principal atmospheric emissions from the facility would be NO_x, SO_2, and particulates. Dispersion of these emissions would be assisted by use of a 490 foot tall chimney. A Prevention of Significant Deterioration (PSD) review has been conducted for this project. PSD analysis indicated that air quality changes in the surrounding Class II area and at the Chassahowitzka National Wilderness Area (a class I area) approximately 92 kilometers distant would be within allowable PSD increment levels. Based on this analysis, state and federal air quality standards would not be violated. Negligible effects on local air quality would be anticipated. Extensive investigations are currently in progress toward understanding the globally significant acid rain problem. SO_2 and NO_x emissions from Unit 4 would potentially contribute to this phenomenon. The long term effect on acid rain production is unknown.

No impacts to wetlands, threatened/endangered species, significant historical/archaeological sites, or agricultural lands would occur as a result of Big Bend 4.

Operation of Unit 4 would generate considerable residual wastes that would require disposal. The proposed onsite landfill that may be utilized represents a long-term commitment of this land and reduces the potential future uses of the land.

Operational impacts on the socioeconomics of the area are generally considered minor. Operation of Unit 4 would generate 50 permanent positions in the community. The direct economic effects would yield approximately $1,400,000 in annual payroll. The proposed facility is compatible with current area land-use plans. The existing public, medical, recreational, and cultural facilities within the surrounding areas would not be impacted by this facility. No significant noise impacts would be anticipated.

5. Mitigation Measures

Several measures which would serve to mitigate the impacts of the proposed project on the surrounding environment were identified during the environmental review process. These measures are outlined below:

- Implement an erosion control and sedimentation program during construction to reduce potential water quality degradation from soil laden runoff.

- Monitor groundwater quality in the area during operation to determine whether more stringent waste disposal measures are needed.

- Leave undisturbed the mangrove swamp system located along the southwestern coastal portion of the site.

- Install the fine mesh screens on Units 3 and 4 prior to Unit 4 pump testing.
- Implement a biological monitoring program to verify the efficiency of the full-scale fine mesh screen system and organism return mechanism.
- Implement a program to mitigate potential impacts to the West Indian manatee (an endangered species) which, because of heated effluents, is a temporary resident of the discharge canal during the winter .

6. Unresolved Issues

TECO is currently pursuing a variance request to Florida Water Quality Standards with the Florida Department of Environmental Regulation (FDER) and the USEPA. The FDER has made a preliminary recommendation that the variance request be approved for a two year period during which time TECO would further investigate wastewater treatment options. Consequently, TECO has not received a variance to the standards. This issue is expected to be resolved prior to release of the Final EIS. Should a variance not be granted additional wastewater treatment would be required prior to issuance of an NPDES permit.

Additionally, TECO is pursuing a variance request from local water quality standards through the FDER and the Hillsborough County Environmental Protection Commission. This issue is as yet unresolved. Resolution is expected prior to release of the Final EIS.

TECO proposes to use chlorine as a biofouling agent in the condenser cooling system. Chlorine discharges of 0.2 mg/l (expressed as total residual oxidants, TRO) would be the maximum concentration released. It is yet unresolved whether 0.2 mg/l TRO represents an acceptable limitation to adequately protect the aquatic organisms in the TECO discharge canal. A preliminary assessment has shown that a TRO level of 0.2 mg/l would adequately protect aquatic organisms in the discharge canal. Resolution of this issue is expected prior to release of the Final EIS.

FOREWORD

The Tampa Electric Company (TECO) proposes to construct a 417-megawatt (net) coal-fired steam electric-power-generating unit at Big Bend Station on Tampa Bay, south of Tampa, Florida. A detailed description of the project and its environmental consequences is the subject of this draft environmental impact statement (EIS).

In format and content, this document conforms to guidelines established by the Council on Environmental Quality (40 CFR 1500-1508) and the U.S. Environmental Protection Agency in accordance with the National Environmental Policy Act (NEPA). These guidelines make it clear that the EIS is a summary document written to provide the decisionmaker and the public with relevant information on the advantages and disadvantages of a proposed action. It is analytical rather than encyclopedic and emphasizes only the issues of major significance. It is also a concise document, being no longer than necessary for strict compliance with NEPA requirements.

The issues addressed in this draft EIS include the purpose of the project and the need for action (Chapter 1); the alternatives considered, including the proposed action (Chapter 2); and the environmental setting of the project and probable environmental impacts (Chapter 3). In Chapter 4, the unavoidable adverse impacts of the proposed action are summarized and the commitments of resources are clearly identified.

An accompanying Technical Reference Document (TRD) provides detailed technical information and environmental impact assessments that support the major findings and conclusions of the draft EIS. A limited number of copies of the TRD are available for review at the following locations:

U.S. Environmental Protection Agency
EIS Branch
345 Courtland Street, N.E.
Atlanta, Georgia 30365

U.S. Army Corps of Engineers
Environmental Planning Branch
P.O. Box 4970
Jacksonville, Florida 32201

Tampa-Hillsborough County Public Library System
900 N. Ashley Street
Tampa, Florida 33602

University of South Florida
Tampa Campus Library
4202 E. Fowler Avenue
Tampa, Florida 33620

University of South Florida
Bay Campus Library
830 First Street S.
St. Petersburg, Florida 33701

University of Tampa Library
401 W. Kennedy Boulevard
Tampa, Florida 33606

Hillsborough Community College Library
Palm and 15th Streets
P.O. Box 22127
Tampa, Florida 33622

St. Petersburg Public Library
3745 9th Avenue N.
St. Petersburg, Florida 33713

St. Petersburg Municipal Reference Library
175 5th Street N.
St. Petersburg, Florida 33701

St. Petersburg Junior College Library
6605 Fifth Avenue N.
St. Petersburg, Florida 33710

Clearwater Public Library
100 N. Osceola Avenue
Clearwater, Florida 33515

Sarasota Public Library
701 Plaza de Santo Domingo
Sarasota, Florida 33577

Bradenton Public Library
1405 Fourth Avenue W.
Bradenton, Florida 33505

Manatee County Library System
417 12th Street W.
Bradenton, Florida 33505

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Chapter 1

PURPOSE AND NEED FOR ACTION

1.1 NEED FOR ACTION

The action as defined for this document is the issuance by the U.S. Environmental Protection Agency (EPA) of a National Pollutant Discharge Elimination System (NPDES) permit to Tampa Electric Company for the proposed Big Bend Unit 4.

Under provisions of the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 466 et seq.) the Tampa Electric Company has applied to the EPA for an NPDES permit for the proposed power plant. In compliance with its responsibility under the National Environmental Policy Act (NEPA) of 1969, the EPA has determined that the issuance of an NPDES permit for the proposed project would constitute a major Federal action significantly affecting the quality of the human environment and is subject to the provisions of NEPA. Prior to a decision on and issuance of the permit, Council of Environmental Quality and EPA procedures for implementing NEPA (40 CFR 1500-1508 and 40 CFR 6, respectively) require an environmental impact statement that identifies impacts of the proposed action and alternatives on the natural and human environments.

This draft environmental impact statement (EIS) and draft NPDES permit have been prepared to provide Federal, State, and local agencies and the concerned public with sufficient and comprehensible information on the proposed project, the alternatives to the project, and the EPA's proposed action.

1.2 IDENTIFICATION OF THE APPLICANT

The Applicant is the Tampa Electric Company (TECO), with headquarters at 111 North Dale Mabry Highway, Tampa, Florida. Incorporated in December 1899 and reincorporated in 1949, TECO is a public utility operating wholly within the State of Florida. The company is principally engaged in the generation and sale of electricity. The Applicant is a member of the Florida Electric Power Coordinating Group (FCG) and actively participates in the coordination, planning, and operation of the Peninsular Florida Electric System.

TECO serves an area of nearly 1900 square miles on the central west coast of Florida, including all of Hillsborough County and parts of Pasco, Pinellas, and Polk Counties. More than 700,000 persons live in these areas. TECO serves approximately 296,000 customers. It has 2,390 employees and 14,000 common shareholders. TECO's service area is shown in Figure 1-1 (TECO, 1980).

TECO produces electricity in three wholly owned power plants located on or near the eastern shores of Tampa Bay. The units in these plants have a generation capability mix of approximately 65 percent coal, 29 percent No. 6 low-sulfur oil, and 6 percent No. 2 low-sulfur oil. The energy produced from these plants has a generation mix of approximately 80 percent coal, 19 percent No. 6 fuel oil, and 1 percent No. 2 low-sulfur oil (System Planning Committee, 1979).

Hookers Point Station is the oldest of TECO's three power plants. It is located just southeast of the Tampa business district on Hookers Point, fronting the Seddon Ship Channel. Hookers Point boilers burn No. 6 low-sulfur fuel oil.

Gannon Station is 6 miles south of Tampa. Its addition to TECO's system began in the 1950s, when Florida's growth was extremely rapid. Six of the units went into service between 1957 and 1967, and all of them originally burned coal. To comply with environmental requirements, the first four units were converted to No. 6 low-sulfur oil in 1975 and 1976. Units 5 and 6 burn low-sulfur coal. An additional 14-megawatt gas turbine, which burns No. 2 low-sulfur oil, is also located at Gannon Station. The Applicant plans to convert the first four units back to coal beginning in 1983.

Big Bend, 10 miles south of Tampa, TECO's newest power plant, is designed to be efficient and to operate in harmony with the environment. Three units are burning coal. One 14-megawatt and two 65-megawatt gas turbines, which burn No. 2 low-sulfur oil, are located just north of Big Bend Station.

Presently, TECO's three power plants have a total net generating capability of 2495 megawatts (TECO, 1980).

1.3 NEED AND PURPOSE FOR BIG BEND UNIT

The Applicant's charter is to provide electric power reliably, at a reasonable price, and to maintain the system in a manner consistent with those objectives. The proposed facility is not intended for other purposes, such as the production of steam for resale.

TECO is an active participant in the FCG as well as the FCG System Planning Committee. The 1979 Annual Peninsular Florida Generation Reliability Study indicates that, for the period of 1979 through 1988, the loss-of-load probability for peninsular Florida will range from 0.03 day per year (1979) to 0.18 day per year (1988), compared to the desired value of 0.1 day per year (System Planning Committee, 1979). This estimate includes currently planned additions.

Based on the projected load growth, the net summer and winter peak demands are forecast to increase by about 64 and 86 megawatts per year, respectively, averaged over the period 1981-1989 (TECO, 1980). This need can best be met by (1) the addition of Big Bend Unit 4 to existing baseload capacity in 1985, (2) the realization of a projected joint generating facility in 1989, and (3) provisional power purchases.

A unit power contract involving Big Bend Unit 4 has been negotiated between TECO and another utility for the period 1985 through 1987. The other utility will receive shares of Unit 4 generating capacity according to the following schedule established by TECO: approximately 70 percent in 1985, 50 percent in 1986, and 25 percent in 1987.

TECO is pursuing joint ownership for future generation expansion. To meet future baseload requirements, coal and nuclear power will continue to be reviewed to determine the most economical and feasible approach to generation expansion.

TECO has full interchange agreements with the Florida Power and Light Company, the Florida Power Corporation, and the City of Lakeland. In addition, TECO has economy interchange agreements with the Fort Pierce Utilities Authority, the Orlando Utilities Commission, and Vero Beach Municipal Utilities. TECO will participate in economy interchange transactions whenever practical and possible.

TECO has an obligation to contribute its fair share of the generating additions to maintain the reliability of the peninsular Florida system. Major objectives are to maximize the benefits of joint operation, to minimize the effects of generation outages associated with the functioning of a large electric-power-supply system, and to contribute a fair share to the ensurance of system reliability. TECO's fair share is determined through an evaluation of its reliance upon the peninsular Florida generation and interconnection system. According to TECO's site certification application (TECO, 1979), the 1978-1979 total system winter peak demand for TECO is 10.5 percent of the total system peak of peninsular Florida.

Table 1-1 shows the effect on TECO's system reserves of postponement of the inservice date of Big Bend Unit 4; the firm-load winter reserves for 1985-1986 would drop to 9 percent from the projected 26 percent.

Should TECO experience a capacity deficiency, the load would be reduced through priority assignments to ensure system stability. This is a short-term plan, however, and not a substitute for good system reliability planning. The plan, beginning with the curtailment of the interruptible load, is frequently implemented in varying degrees. The latter phases of the plan, involving the curtailment of firm load, have been required only on very rare occasions. A snowfall in Tampa on January 18, 1977, is an example.

Findings of the Florida Public Service Commission (FPSC) make it clear that the achievement of energy-conservation goals would make the addition of the Big Bend Unit 4 to the peninsular Florida system unnecessary. If the goals are not achieved, additional generating capacity may be required. The FPSC has stated, however, that additional capacity will be needed in the TECO service area despite attainment by that utility of its conservation goals. Therefore, any further delay in constructing Big Bend Unit 4 could jeopardize future service to customers (Appendix G).

Alternatives to this project (e.g., purchase of power and the reactivating and uprating of units) are discussed in Section 2.2.

Another consideration is the value of Big Bend Unit 4 as an alternative to foreign oil for the generation of electricity. Based on evidence presented during the need-for-power proceedings, the FPSC has concluded that the operation of Big Bend Unit 4 could reduce by approximately $232 million (1980 dollars) Florida's dependence on imported oil.

The FPSC's Order on the need for Big Bend Unit 4 is included as Appendix G.

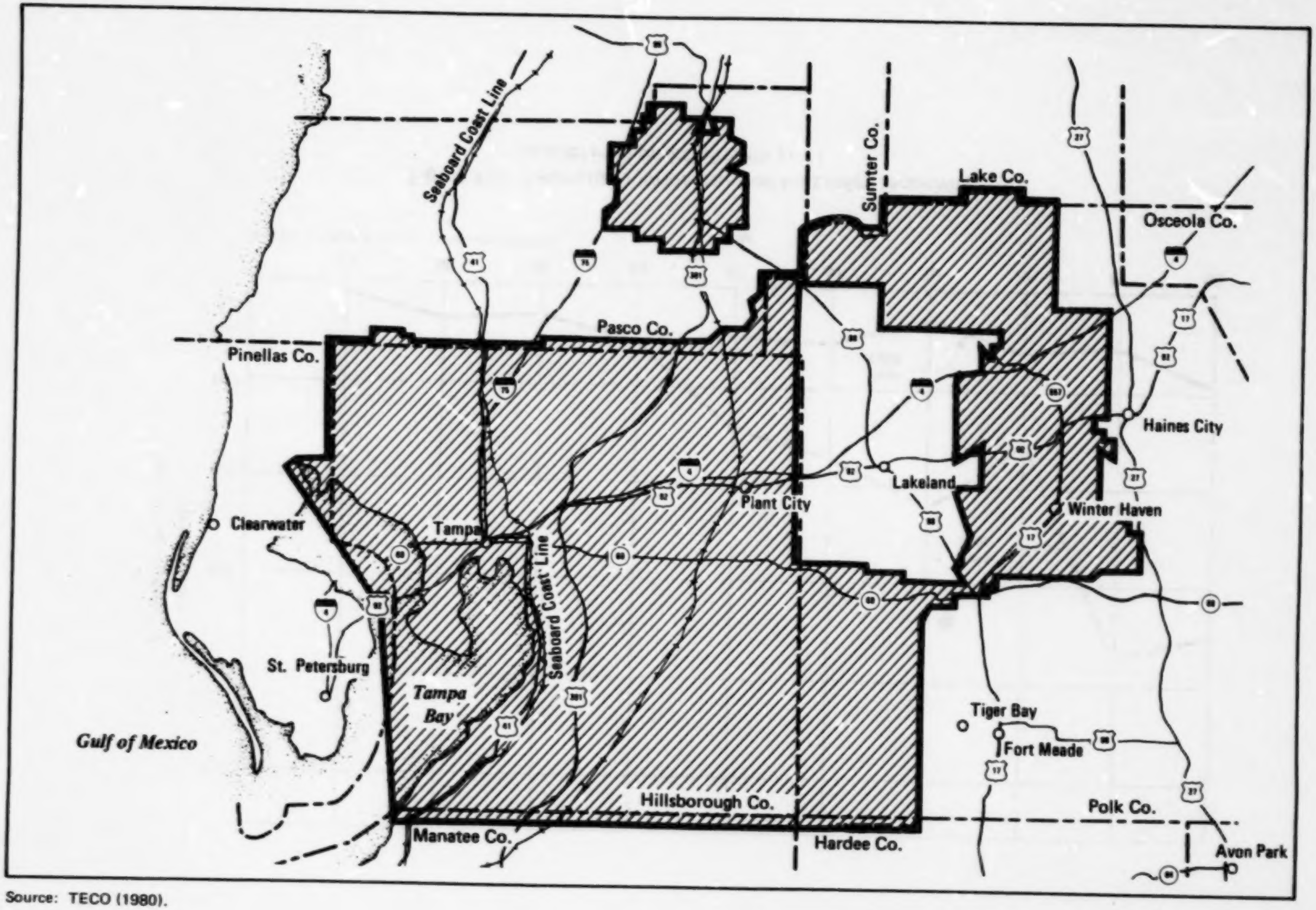
Table 1-1. Ten-year forecasts of capacity and demand during summer and winter peaks for Tampa Electric Company[a]

Year	Peak demand[b] (MW)	Capacity with Big Bend 4			Margin with Big Bend 4		Margin without Big Bend 4	
		Total installed capacity[b] (MW)	Firm capacity import[b] (MW)	Total available capacity[b] (MW)	MW	Percent of peak	MW	Percent of peak
Summer forecast								
1980	1860	2495	—	2495	635	34	—	—
1981	1920	2520	—	2520	600	31	—	—
1982	1984	2520	—	2520	536	27	—	—
1983	2064	2520	350	2870	806	39	—	—
1984	2124	2520	350	2870	746	35	—	—
1985	2188	2937	58	2995	807	37	—	—
1986	2247	2937	142	3079	832	37	390	18
1987	2309	2937	246	3183	878	38	415	18
1988	2372	2937	350	3287	915	39	457	20
1989	2439	3337	—	3337	898	37	498	21
							481	20
Winter forecast								
1980-81	2047	2495	—	2495	448	22	—	—
1981-82	2122	2520	—	2520	398	19	—	—
1982-83	2199	2520	—	2520	321	15	—	—
1983-84	2284	2520	350	2870	586	26	—	—
1984-85	2362	2520	350	2870	508	22	—	—
1985-86	2448	2937	142	3079	631	26	—	—
1986-87	2537	2937	246	3183	646	25	214	9
1987-88	2630	2937	350	3287	657	25	229	9
1988-89	2726	2937	350	3287	561	21	240	9
1989-90	2825	3337	—	3337	512	18	144	5
							95	3

Abbreviation: MW = megawatts.

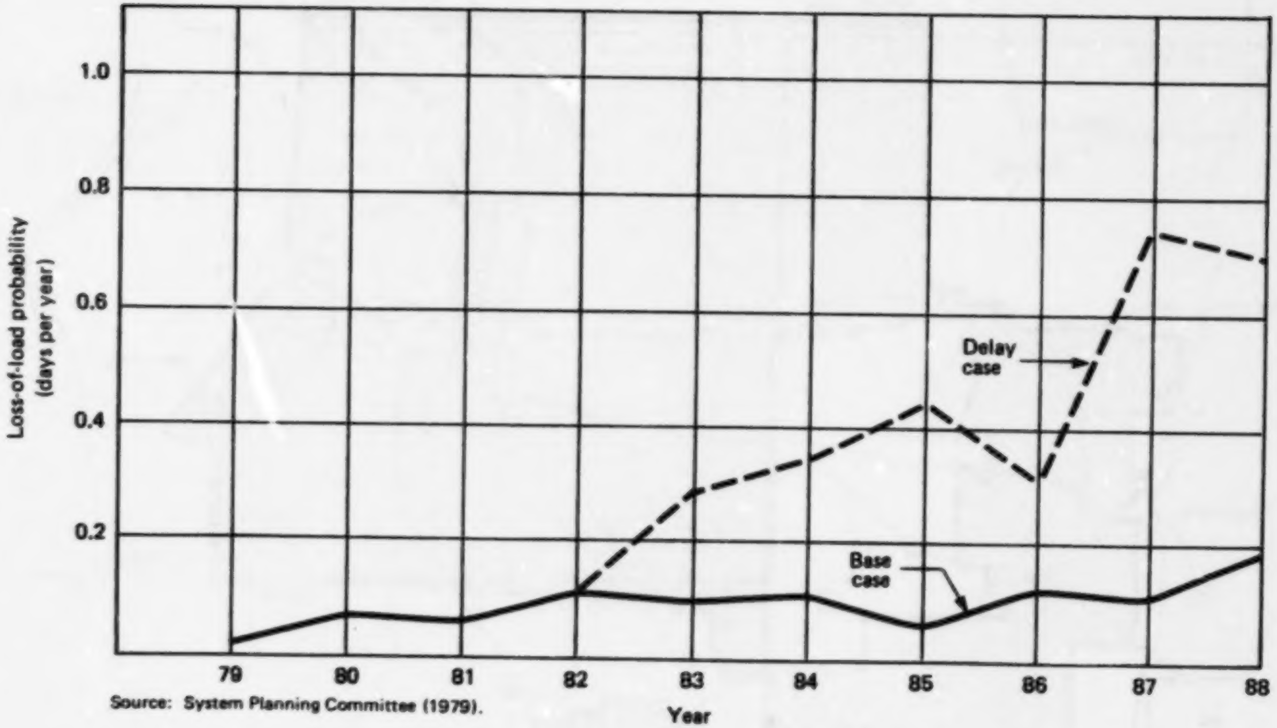
[a] Status as of December 31, 1979.
[b] Data from TECO (1980).

Note: Capacity changes must be made by November 30 to be considered in effect at the time of the winter peak. All megawatt values are net megawatts.


Seaboard Coast Line
Sumter Co.
Lake Co.
Osceola Co.
Pasco Co.
Pinellas Co.
Haines City
Lakeland
Plant City
Winter Haven
Clearwater
Tampa
Seaboard Coast Line
St. Petersburg
Tampa Bay
Gulf of Mexico
Tiger Bay
Fort Meade
Hillsborough Co.
Polk Co.
Manatee Co.
Hardee Co.
Avon Park
0
10
20
30 Miles

Source: TECO (1980).

Figure 1-1. Service area, Tampa Electric Company.



Source: System Planning Committee (1979).

Figure 1-2. Peninsular Florida baseload-unit delay sensitivity (loss-of-load probability by year).

REFERENCES FOR CHAPTER 1

System Planning Committee. 1979. Peninsular Florida generation reliability assessment study, 1979-1988.

TECO (Tampa Electric Company). 1979. Site certification application, Big Bend Station Unit 4.

TECO (Tampa Electric Company). 1980. Ten-year plan for electrical generating facilities and associated transmission lines, 1-1-80 to 12-31-89.

Chapter 2

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

The plan proposed by the Tampa Electric Company (TECO) for Big Bend Unit 4 was selected from a number of possible alternatives. The factors considered during the various selection processes included engineering, environmental, socioeconomic, and regulatory requirements and costs of development.

This chapter addresses the alternatives considered by TECO during the development of plans for the proposed project as well as alternatives available to the U.S. Environmental Protection Agency (EPA) and State permitting authorities.

2.1 NO-ACTION ALTERNATIVE

The no-action alternative would be a denial of the National Pollutant Discharge Elimination System (NPDES) permit for Unit 4 by the EPA.

The number of customers relying on TECO for electric power is projected to increase from about 316,000 in 1980 to about 429,000 in 1990. Total sales are projected to increase from 10,141 gigawatt-hours in 1979 to 11,891 in 1985 and to 12,980 in 1989. While industrial consumption is currently about 23 percent higher than residential consumption (1979), the difference is expected to decrease to 18 percent by 1985 and to only 10 percent by 1989. Based on the projected load growth, the net summer peak demand is forecast to increase by an average of approximately 64 megawatts per year averaged over the period 1981-1989. However, the forecast increase in the net winter peak demand is approximately 86 megawatts per year. TECO's reserve, with Big Bend 4 operating, is projected to be in the 20 to 25 percent range in the late 1980s. Without this unit, the reserve would drop to 3 to 9 percent despite the importation of several hundred megawatts of capacity during the same time span (Table 1-1). The guideline for reserve capacity is usually about 25 to 30 percent for an individual system such as TECO's. The expected consequence of the lowered reserve capacity is the loss of a reliable supply of electric power.

Should TECO experience a capacity deficiency, it would implement a plan of priority assignments to reduce the load and ensure system stability. This is a short-term plan, however, and cannot be relied on in lieu of long-term system planning. The plan, beginning with curtailment of the interruptible load, has frequently been implemented in varying degrees. The latter phases of the plan, involving curtailment of firm load, have been required only on very rare occasions, as on January 18, 1977, when it snowed in Tampa.

Should an NPDES permit not be issued, TECO could investigate possibilities for the purchase of power from other utilities to meet projected capacity needs. The purchase-of-power option is addressed in more detail in Section 2.2.1.

The consequences of no action could be mainly socioeconomic. The lack of reliable power supplies might, for example, discourage the development of the economic sectors needed to support the rapidly growing population, thus affecting the availability of employment in the area. As for the physical environment, there would be no additional impacts on local air, land, or water resources other than those attributable to the operation of Units 1, 2, and 3.

2.2 MANAGEMENT ALTERNATIVES

2.2.1 PURCHASE OF POWER

The purchase of power--assuming it were available--from other Florida utilities would be the same as the no-action alternative, considering its potential effect on the availability of energy in Florida. The purchase of power from outside Florida--if adequate transmission facilities existed--would provide a temporary solution to the need for power by the State, but it would result in a concurrent reduction in the reserves of the supplying utility. While the purchase of power can be a short-term solution, it is becoming more difficult to obtain the necessary approval for the construction of additional capacity for long-term sales to other utilities. The Applicant has not actively pursued long-term power purchases outside Florida because of questions relating to the transmission line/intertie capability to sustain long-term loads.

An option available to TECO should an NPDES permit not be issued is the purchase of power. The FPSC has stated that purchase-of-power contracts with Florida and out-of-state utilities have been investigated by TECO. The Florida Power Corporation (FPC) and Florida Power & Light (FPL) have no capacity available from their certified units. Further, efforts to obtain capacity from other utilities have been shown to be neither cost- nor time-effective. (See Appendix G.)

A firm-capacity purchase contract is being negotiated to replace combustion turbines that were being considered for operation in 1983 and 1984. The contract calls for the purchase of power from a new coal unit, which would have the effect of reducing the need for more expensive oil-generated power in TECO's system. Adequate emergency power is normally available through ties with the Florida Power Corporation, the Florida Power and Light Company, and the City of Lakeland. In addition, the Applicant participates in economy interchange transactions on an hourly basis to reduce the expense of total system operation.

2.2.2 JOINT PROJECTS WITH ADJACENT UTILITIES

TECO is pursuing joint ownership for future generation expansion. To meet future baseload requirements, coal and nuclear power will continue to be reviewed to determine the most economical and feasible means of generation expansion. By using economy of scale, two or more utilities may benefit from joint ownership. Several jointly owned units are currently planned by other Florida utilities for online service in the mid-1980s.

TECO has three full interchange agreements with the Florida Power and Light Company, the Florida Power Corporation, and the City of Lakeland. It also has economy interchange agreements with the Fort Pierce Utilities Authority, the Orlando Utilities Commission, and Vero Beach Municipal Utilities, and will participate in other economy interchange transactions whenever practical and possible.

TECO's 1980 10-year site plan does not include the addition of combustion turbines at Big Bend in 1983 as discussed in the 1979 plan. The 1980 plans reflect an upgrading of Big Bend Unit 2 by 25 megawatts for the summer and the winter. In addition, TECO is planning on participating in a joint-generating, 800-megawatt coal-fired unit scheduled for 1989 startup, with TECO retaining approximately 400 megawatts.

TECO has negotiated a contract with Florida Power and Light Company (FP&L) for the sale of power from Big Bend Unit 4 on a decreasing annual basis for the first 3 years of operation. The capacity sold to FP&L will be in accordance with the schedule of need as determined by FP&L, but it will not exceed an amount set by TECO. This will allow TECO to ensure reliable service to its customers. The amount of Big Bend Unit 4 capacity available to FP&L will be approximately 70, 50, and 25 percent for the years 1985, 1986, and 1987, respectively.

2.2.3 OTHER MANAGEMENT ALTERNATIVES

Other management alternatives that have been considered include conservation, the uprating of older generating units, the reactivation of retired facilities, and the construction of a smaller facility.

2.2.3.1 Conservation

The Florida Public Service Commission, pursuant to the Florida Power Plant Siting Act (Florida Statutes, Chapter 403), prepared an Order and a final report to the Florida Department of Environmental Regulation as to the present and future need for the proposed Big Bend Unit 4. A copy of the Order is contained in Appendix G. In its deliberations on the issue of need, the Commission took into consideration the conservation goals for Florida electric power utilities established by its Order 9634, issued on November 13, 1980. The Commission concluded that, if its conservation goals are achieved, Big Bend Unit 4 may not be needed from the standpoint of the peninsular system's capacity. However, the Commission also concluded that it appears that the proposed unit is needed for TECO's system, whether or not TECO achieves the conservation goals allocated to it by the Commission. Accordingly, conservation was not considered to be an appropriate management alternative.

2.2.3.2 Uprating of Older Units

While the uprating of older units can be a solution to a utility's capacity needs, this is generally true only for larger utilities, where the necessary increase in capacity is only a small fraction of the entire system's capability. This is not the case for TECO. About 15 percent in additional capacity is required in the mid-1980s, and it is not possible to uprate the existing units to achieve this additional capacity. One alternative to the uprating of existing units is the deferral of the planned derating of such units. In the time span of concern, TECO will not be derating any units that could be retained online. In fact, the total derating occurring among other Florida utilities during the period 1980-1985 is approximately half the capacity of Big Bend Unit 4. Consequently, the uprating of TECO's older units is not considered a feasible alternative to the construction of Big Bend Unit 4.

2.2.3.3 Reactivation of Retired Facilities

TECO does not have any retired units that could be activated as an alternative to Big Bend Unit 4, and it does not plan on any retirements during the time span of concern.

2.2.3.4 Construction of a Smaller Facility

TECO has considered a reduction in size of the planned coal-fired unit and, alternatively, the construction of a smaller unit such as a gas turbine. While a smaller unit can be constructed more quickly, the cost per megawatt is usually very high. The availability of alternative oil or gas fuels is also a questionable factor, as discussed in Section 2.3. An additional consideration is the new-source performance standard of the EPA, which requires the scrubbing of all new boiler emissions and documentation of the historical performance of flue-gas-scrubbing equipment. Excess flue-gas-scrubber capacity may be necessary to maintain the baseload capability of the proposed generating unit in the event of a scrubber malfunction requiring shutdown for maintenance. The additional scrubber costs may have a smaller per-unit energy impact in larger plants.

2.3 POWER-GENERATION ALTERNATIVES

In evaluating energy alternatives, TECO determined that coal was the most feasible energy source. Other potential sources considered were nuclear fission, oil, natural gas, municipal solid waste, solar-thermal power, wind, and biomass.

2.3.1 COAL (APPLICANT'S PROPOSED ALTERNATIVE)

Coal is the most feasible energy alternative for Unit 4 for many reasons. Three coal-fired electricity-generating units are presently operating at the Big Bend site. Thus, coal-handling and transportation facilities are already in place and will require minimal expansion to accommodate the new unit. Finally, the Applicant has established an adequate supply of coal for the next 10 years. The most obvious disadvantage of this fuel is that all new coal-fired boilers will require flue-gas cleaning to reduce emissions. The introduction of cleaning equipment at other facilities has resulted in reduced reliability, problems in solid-waste disposal, and increased capital and operating costs.

2.3.2 NUCLEAR FISSION (URANIUM)

The lead time required for the licensing, design, and construction of a nuclear-fuel-generating facility is presently close to 10 years. As a result of the Three Mile Island incident, the schedule for the licensing of proposed new units is largely conjectural. The power from TECO's proposed generating facility is needed by the mid-1980s. The proximity of Big Bend to the more populated areas of Hillsborough County militates against locating a nuclear plant at that site. Furthermore, the cooling-water requirements of nuclear power plants are considerably greater than those of coal-fired units because nuclear plants have a lower thermal efficiency and release no waste heat to the atmosphere. For these reasons, nuclear fuel is not considered a feasible alternative for Unit 4.

2.3.3 OIL AND NATURAL GAS

The Power Plant and Industrial Fuel Use Act of 1978 (PL 95-620) prohibits the use of residual fuel oil and natural gas as boiler fuels in baseload-generating facilities, and the U.S. Department of Energy is encouraging the conversion of existing units to coal use. Thus, oil and natural gas cannot reasonably be considered for use in new, large-scale electricity-generating facilities.

2.3.4 OTHER ALTERNATIVES

Several other alternative energy sources were considered for power generation, but none were deemed feasible for fulfilling TECO's requirements.

2.3.4.1 Municipal Solid Waste

The use of municipal solid waste as an alternative energy source is limited by stringent air quality standards and by the lack of a viable collection and preparation system. The emission problems of an incinerator are generally more severe than those of conventional fossil-fueled plants because of the greater variety of materials that are burned. Municipal solid waste has also been shown to be less economical than conventional fuels like coal. The Applicant has concluded that the combustion of municipal solid waste is not a reasonable alternative in view of its costs, size limitations, and environmental implications.

2.3.4.2 Solar-Thermal Technology

The use of a solar-thermal central station for power production has not yet been demonstrated. However, the Department of Energy (DOE) and the Environmental Protection Research Institute are jointly developing a 10-megawatt central receiver pilot plant, with initial plant operation set for the early 1980s. Plans call for a 100-megawatt demonstration plant in the mid-1980s and a 100-megawatt prototype commercial plant in the 1990s.

When solar-thermal power conversion is shown to be technically feasible and economically competitive with other power sources, it will be necessary to consider its environmental impacts. The most notable impacts will be the large land area (many square miles) required for a baseload facility and the aesthetic impact of the solar collection system. There are too many unknown factors related to the technical and economic feasibility and the environmental impacts of solar-thermal power production for this approach to be considered a reasonable alternative to the proposed generating facility.

2.3.4.3 Wind Power

The wind has been used extensively as a source of power for the pumping of water and (before the Rural Electrification Administration) for the generation of electricity for farms. However, it does not as yet represent a proven alternative to conventional baseload-generating facilities, even though the DOE has funded several small wind generators as well as a 10-megawatt multiunit system that is scheduled for completion in the mid-1980s. In view of the current state of the technology and the timetable for future tests, it is unlikely that wind power will be able to provide substantial baseload capacity in the near future.

2.3.4.4 Fuel from Biomass

Several methods of producing fuel from biomass are currently being tested with a view to making use of the large quantities of municipal and agricultural organic wastes available. The methods under consideration, however, show little promise of yielding the quantities of fuel needed to operate a baseload electricity-generating facility at a cost that is competitive with fossil fuels. Methane, a low-Btu fuel gas, and fuel oils produced from biomass could serve as substitutes for natural gas and fuel oil; however, their use as utility boiler fuels would in all probability be preempted by other, higher priority uses.

2.4 SITE ALTERNATIVES

The site-selection process for Big Bend Unit 4 consisted of three stages. In the first stage, area-wide screening for general environmental suitability was conducted. The purpose was to identify favorable and restricted areas in Hillsborough, Polk, Pasco, Pinellas, Manatee, and Hardee Counties. The favorable areas were then screened for conformity with certain requirements, and 13 candidate sites were identified. In the second stage, the candidate sites were evaluated and ranked for suitability according to the environmental criteria and the site requirements. This analysis identified the three most favorable sites. The third stage consisted of three phases: (1) a sensitivity analysis of the evaluation methods to determine how possible changes in the subjective evaluations would affect the recommendation of the most favorable site; (2) a detailed engineering cost analysis to establish a ranking of the three prime sites; and (3) a detailed licensability analysis of the most favorable site to verify the existence or nonexistence of fatal flaws.

Five environmental criteria were used in the initial screening to determine the suitability of specific site areas:

- Water quality/quantity
- Air quality
- Land-use compatibility
- Ecological quality
- Geotechnical suitability

Figure 2-1 is a map showing the composite ratings that resulted from this screening. The criteria used for the second part of the initial screening related to the potential of the unit for reliable and economical operation as part of TECO's system. These criteria included the following:

- The distance to the connection with TECO's transmission system
- The availability of existing transmission facilities with adequate capacity
- Alternative transmission routes to the system
- Alternative modes of fuel delivery
- The stability of the generator connection with the system

The most favorable sites were then compared in terms of criteria relating to the availability of land and cooling water. Thirteen sites were thus identified (Figure 2-2).

In the second-stage screening, these sites were further evaluated in terms of 21 specific site-suitability criteria. The sites were rated for each criterion by consultants with relevant expertise. These ratings were based on the results of site visits and on information obtained from secondary sources. The ratings ranged from 1 to 5, with 5 indicating the highest suitability for that criterion. Site scores for each criterion were obtained by multiplying the rating by the weight for that criterion (Table 2-1). The summation of a site's scores for all criteria yielded the total site score (Table 2-2). The higher the numerical score, the more suitable the site. An analysis of the total site scores indicates that Site 8A (Big Bend) is significantly more suitable than the other sites. Sites 7 (Peace Creek), 2 (Highland), and 3A (Strip Mine) were the most suitable alternatives.

Because of the subjectivity inherent in the weighting/rating system for the sites, a sensitivity analysis was performed to determine the effects of variations in input data on the site-suitability scores and on the overall rankings. This analysis demonstrated the degree to which selection of the recommended site was affected by reasonable changes in the weighting and rating systems. The results of this analysis show that Big Bend is the preferred site, with Peace Creek and Highland ranked second and third, respectively.

A detailed analysis was also performed to determine the costs of constructing and operating power plants at each of the preferred sites. Estimates of capital costs, recurrent (annual) costs, and total annual costs above the base case were developed. These estimates (in 1985 dollars) are presented in Table 2-3. This cost analysis indicates that Big Bend is the preferred site for the proposed facility.

The Big Bend site is also preferred on grounds of water availability. At the most suitable alternative sites, Peace Creek and Highland, only limited amounts of water are available.

The Applicant proposes that Big Bend Unit 4 use a once-through cooling system. As an alternative heat-rejection system, a saltwater cooling tower could be erected. Analysis has revealed, however, that such a tower would add to the cost, visual impact, and maintenance of the proposed facility. Environmental damage from salt drift would also be possible; thus, any saltwater cooling tower for the site would have to be designed so as to minimize the adverse effects of salt deposition on local vegetation. The inability to design the tower for adequate drift control would constitute a fatal flaw for saltwater makeup, in which case other sources of cooling-tower makeup water, such as nonpotable ground water or sewage-treatment-plant effluent, could be considered.

The potential need to augment the treated-wastewater source with ground water and/or surface water may represent a fatal flaw for the Peace Creek site. The Southwest Florida Water Management District is on record as opposing the use of ground water for power-plant cooling and is reluctant to approve the use of fresh surface water for this purpose. There is also the possibility that an agreement could not be reached with the City of Winter Haven for the use of its treated wastewater. The resistance centers on the problem of the disposition of the water after its use. The wastewater would necessarily be concentrated for the cooling application before being discharged into the environment. A serious disposal problem could develop if the resulting concentration of toxic materials and other pollutants present in the water violated existing water-quality standards. This problem would be compounded by any constraints on the construction of cooling ponds in central Polk County.

The Highland site would use the waters of Lake Hancock, which would require Section 316 Demonstration studies under Federal law and would encounter opposition from both Federal agencies and the Southwest Florida Water Management District. Furthermore, Lake Hancock may not be a reliable source of water for the 35-year life of the plant. The lake empties into underground caverns at irregular intervals. While drainage control structures could be emplaced on the lake bottom, they might disrupt the biological and human systems that depend on the lake. This represents a potential disqualifying flaw for the Highland site.

In addition to best meeting the various criteria of the siting study, the Big Bend site has two other important advantages: it is closest to the major population centers to be served by the new unit, and it is part of a site already committed to power generation. The construction of Unit 4 at Big Bend would thus entail very little disturbance of previously undisturbed environmental areas.

Table 2-1. Siting criteria and relative weights[a]

Siting criterion	Weight
Engineering/economic considerations	
Cooling-water supply	5
Plant service water	3
Rail accessibility	4
Highway accessibility	3
Port accessibility	5
Transmission-line proximity	4
Site preparation	3
Environmental characteristics	
Terrestrial ecology	3
Aquatic ecology	4
Rare and endangered species	5
Sulfur dioxide	4
Particulates	4
Other air pollutants	3
Surface-water quality	2
Ground-water quality	3
Socioeconomic considerations	
Archaeological resources	4
Land-use compatibility	4
Land availability	5
Aesthetics	2
Regional economics	3
Community impact (demographic)	2

[a] From Environmental Science and Engineering, Inc. (1979).

Table 2-2. Suitability scores of alternative sites[a]

Criterion	Criterion weight	Ratings of alternative sites[b]												
		1	2	3A	3B	3C	4	5	6	7	8A	8B	10A	10B
Cooling-water supply	5	2	5	5	3	3	3	1	3	3	5	5	5	3
Plant service water	3	5	5	5	5	5	5	5	5	5	5	4	5	5
Rail accessibility	4	5	5	3	5	4	5	2	5	4	5	4	2	5
Highway accessibility	3	3	5	3	4	5	2	5	5	3	5	3	5	5
Port accessibility	5	2	2	1	2	2	2	2	1	2	5	5	1	2
Transmission-line proximity	4	1	4	4	4	4	3	2	3	4	5	2	4	4
Site preparation	3	2	3	4	4	4	4	3	4	4	4	2	1	1
Terrestrial ecology	3	3	5	3	4	5	4	5	4	5	2	1	3	5
Aquatic ecology	4	3	4	4	4	5	3	4	2	5	2	1	4	4
Rare and endangered species	5	3	4	3	4	4	3	4	4	4	4	1	3	4
Sulfur dioxide	4	5	4	5	5	5	5	5	5	5	4	4	5	5
Particulates	4	2	2	2	2	2	2	2	2	2	1	2	2	2
Other air pollutants	3	1	1	1	1	1	2	1	1	2	1	1	2	2
Surface-water quality	2	3	2	2	2	2	2	2	1	2	4	4	2	2
Ground-water quality	3	3	3	2	3	2	3	2	3	2	2	3	1	1
Archaeological resources	4	4	3	4	3	3	3	3	4	3	4	3	4	3
Land-use compatibility	4	5	2	4	2	1	3	3	2	4	4	5	2	1
Land availability	5	4	2	4	2	3	3	2	4	3	5	5	3	3
Aesthetics	2	4	2	4	2	2	4	2	2	3	3	4	3	2
Regional economics	3	5	5	5	5	5	5	4	4	5	5	3	5	4
Community impact	2	4	3	3	3	3	3	2	3	4	3	4	3	2
Total score[c]		243	256	256	247	251	244	211	247	264	287	239	234	237

---

[a] From Environmental Science and Engineering, Inc. (1979).
[b] See Figure 2-2 for site locations.
[c] Sum of weights times ratings for all criteria.

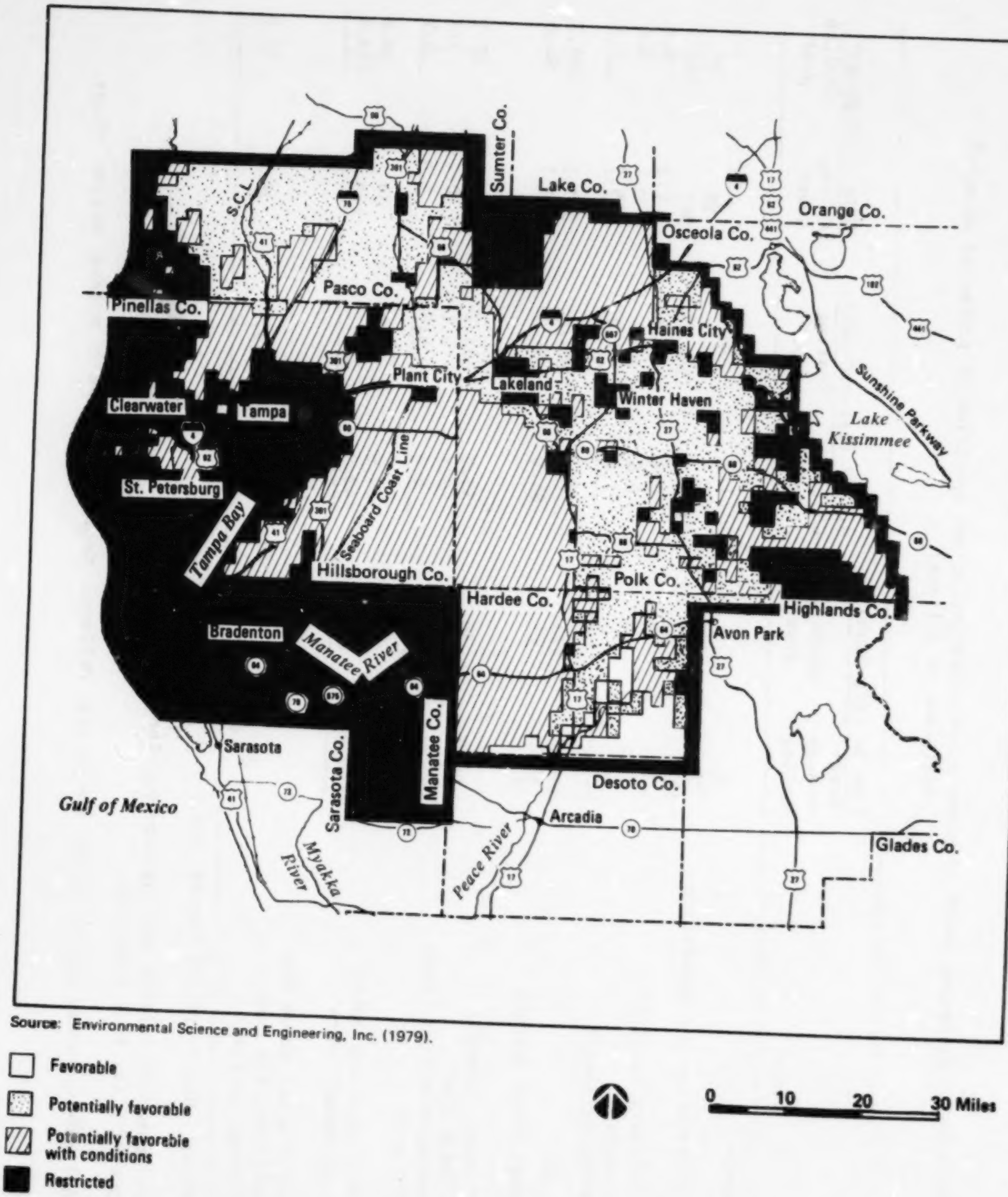
Table 2-3. Estimated costs of power-plant construction and operation at preferred sites[a,b]
(Millions of dollars)

Costs	Site 8A (Big Bend)		Site 7 (Peace Creek)		Site 2 (Highland)	
	Once-through cooling	Cooling tower	Cooling tower	Cooling pond	Cooling tower	Cooling pond
Capital costs						
Land	0	0	1.3	3.4	1.3	3.4
Site preparation and foundation	28	28	28	28	28	28
Plant	371	397	542	542	542	542
Coal-delivery facilities	0	0	0.8	0.8	0.3	0.3
Water supply	0.3	0.3	0.4	0.4	0.4	0.4
Transmission system	0	0	7.0	7.0	5.2	5.2
Total	399.3	425.3	579.5	581.6	577.2	579.3
Annual fixed charges	57.9	61.7	84.0	84.3	83.7	84.0
Recurrent costs (annual)						
Fuel (high Btu)	50.0	50.0	53.2	53.2	53.2	53.2
Transmission-system losses	0	0	0.1	0.1	0.1	0.1
County taxes	6.4	6.5	6.6	6.6	6.6	6.6
Total recurrent costs	56.4	56.5	59.9	59.9	59.9	59.9
Total annual costs	114.3	118.5	143.9	144.2	143.6	143.9
Total annual costs above base case (Site 8A, Big Bend, once-through cooling)	0	4.2	29.6	29.9	29.3	29.6

Abbreviation: Btu = British thermal unit.

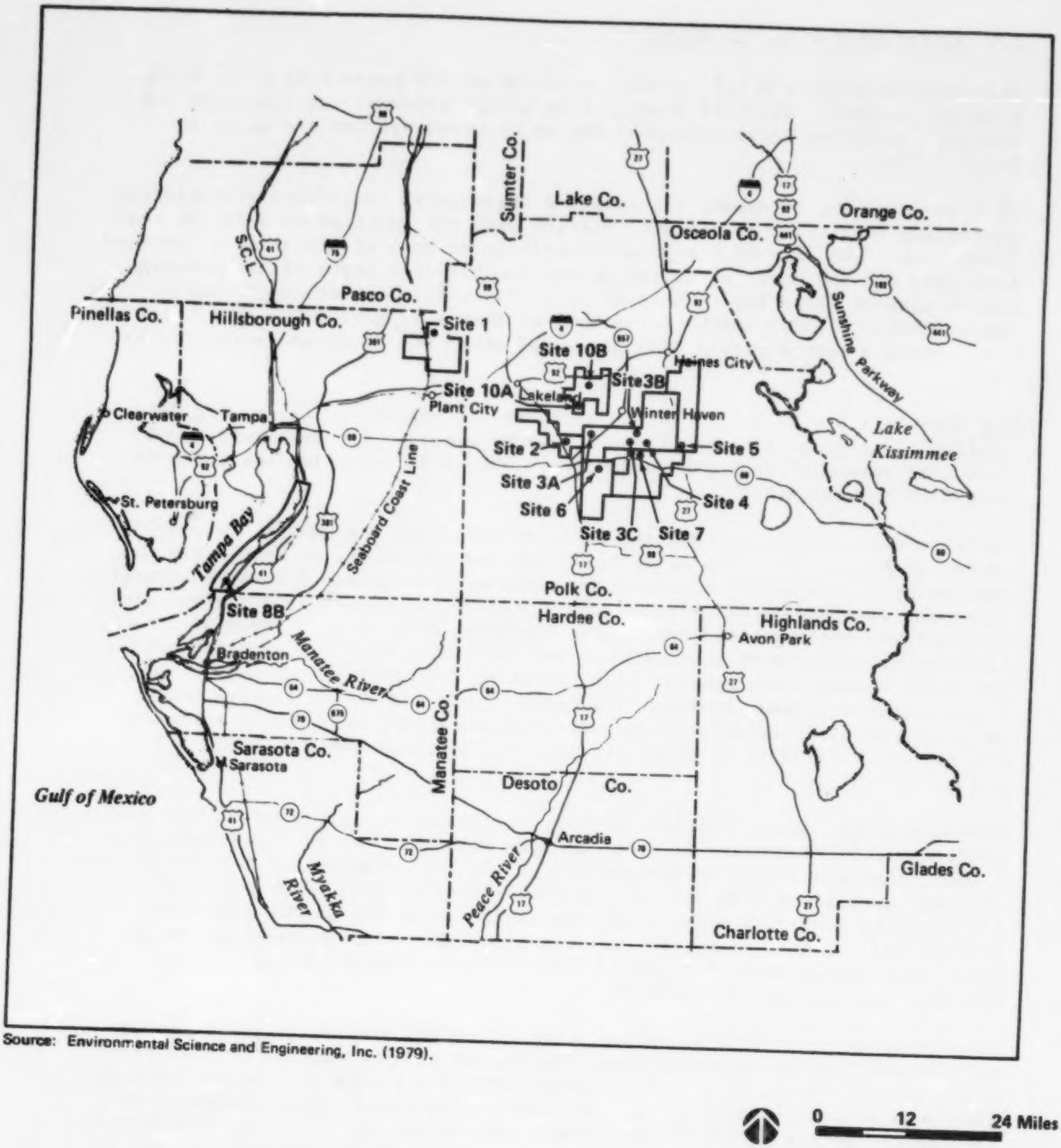
[a] From Environmental Science and Engineering, Inc. (1979).
[b] See Figure 2-2 for site locations.

Note: All costs, except county taxes, are in 1985 dollars. County taxes are in present dollar values.


Sumter Co.
Lake Co.
Orange Co.
Osceola Co.
S.C.L.
Pasco Co.
Pinellas Co.
Haines City
Plant City
Lakeland
Winter Haven
Clearwater
Tampa
St. Petersburg
Tampa Bay
Seaboard Coast Line
Hillsborough Co.
Sunshine Parkway
Lake Kissimmee
Polk Co.
Hardee Co.
Highlands Co.
Avon Park
Bradenton
Manatee River
Manatee Co.
Sarasota
Sarasota Co.
Desoto Co.
Arcadia
Gulf of Mexico
Myakka River
Peace River
Glades Co.
☐ Favorable
▒ Potentially favorable
▨ Potentially favorable with conditions
■ Restricted
0 10 20 30 Miles

Source: Environmental Science and Engineering, Inc. (1979).

Figure 2-1. Environmental composite.


Sumter Co.
Lake Co.
Orange Co.
Osceola Co.
Pasco Co.
Pinellas Co.
Hillsborough Co.
S.C.L.
Site 1
Site 10B
Site 3B
Site 10A
Haines City
Plant City
Lakeland
Winter Haven
Clearwater
Tampa
Site 2
Site 5
Site 3A
Site 6
Site 4
Site 3C
Site 7
St. Petersburg
Tampa Bay
Seaboard Coast Line
Sunshine Parkway
Lake Kissimmee
Polk Co.
Hardee Co.
Highlands Co.
Site 8B
Avon Park
Bradenton
Manatee River
Manatee Co.
Sarasota Co.
Sarasota
Gulf of Mexico
Desoto Co.
Arcadia
Myakka River
Peace River
Glades Co.
Charlotte Co.
0
12
24 Miles

Source: Environmental Science and Engineering, Inc. (1979).

Figure 2-2. Preferred sites.

2.5 APPLICANT'S PROPOSED PROJECT

This section gives a brief, general overview of the project as it is being proposed by TECO. Detailed descriptions of the alternatives that were considered (including those proposed) for major plant systems are given in Section 2.6.

TECO is proposing to expand the existing three-unit, coal-fired electricity-generating facilities at Big Bend Station with the addition of a fourth coal-fired unit. The site of the proposed unit is an area of 521 acres of dredged fill land and 558 acres of upland on the southeastern shore of Hillsborough Bay, a part of Tampa Bay. The area is wholly within Hillsborough County, approximately 5 miles north of the town of Ruskin (Figure 2-3). The total site occupies approximately 1675 acres, of which 800 acres are presently in use.

Big Bend Unit 4 will have a net capacity of 417 megawatts, giving Big Bend Station a net generating capacity of 1503 megawatts. The construction of Unit 4 is scheduled to begin in November 1981, and commercial operation is scheduled for March 1985.

The site plan, which includes the proposed additions for Unit 4, is presented in Figure 2-4. The major buildings and structures of Unit 4 are the turbine hall, the boiler complex, the electrostatic precipitators, the facilities for flue-gas desulfurization (FGD) and FGD byproduct handling and storage, and the cooling-water intake and discharge structures. The unit is designed to share certain structures and facilities with the existing units, including transmission towers, coal unloading and handling equipment, and a wastewater-treatment system. The turbine room and boiler complex will be an extension of existing structures. Combustion gases will be exhausted via the stack for Unit 3, which was designed to accommodate both Units 3 and 4.

When completed, Unit 4 turbine, boiler, precipitator, limestone storage and handling, and FGD systems will occupy approximately 7 acres. Approximately 7 additional acres will be designated for the coal reserve and service facilities associated with Unit 4. Another 121 acres will be used for an ash-settling pond system and approximately 97 acres for an FGD byproduct storage and disposal area. An existing percolation and evaporation wastewater pond with a spray-irrigation field occupies approximately 40 acres and will not require enlargement.

It is proposed that Unit 4 utilize a once-through condenser cooling system with makeup from Hillsborough Bay. The system will be similar to that presently used for Units 1, 2, and 3, except that the intake will be equipped with fine-mesh screens (aperture: 0.5 millimeter) to reduce the entrainment and impingement damage to marine organisms. The intake and discharge structures will be constructed alongside the existing structures for Units 1, 2, and 3. The operation of Unit 4 will require approximately 347 million gallons of cooling water per day, which will increase the total cooling-water requirements of Big Bend Station to 1388 million gallons per day. The maximum design water temperature rise with Unit 4 operating will be 16.8°F.

Unit 4 will burn approximately 950,000 tons of medium-sulfur bituminous coal per year. The coal will be delivered by the existing transport methods (covered barges) and will be handled by the existing facilities. The existing coal-storage field will be modified to accommodate the additional coal to be stored for use in Unit 4.

The freshwater needs of the present facility amount to an average of 1.1 million gallons per day, which is supplied from the South/Central Hillsborough County water system. The operation of Unit 4 will require an additional 2.1 million gallons per day from this source. The plant water balance for the proposed unit is shown in Figure 2-5. The FGD system will use most (1.1 million gallons per day) of this fresh water, and most of the remainder will be used in the bottom-ash system (0.5 million gallons per day) and in the fly-ash, economizer-ash, and pyrites sluicing systems (0.07 million gallons per day). The fresh water will also have limited application as service cooling water and as pump and equipment seal water, and it will be used in fire protection and domestic water systems. Plant recycle water will be used for such purposes as air preheater, precipitator, and boiler washing.

The existing plant wastewater-treatment system consists of an in-plant collection and transportation system, wastewater-treatment ponds, and spray-irrigation or recycling systems. This wastewater system will receive the following wastes associated with operation of Unit 4: all freshwater in-plant waste streams; blowdown from the fly-ash, economizer-ash, and pyrites sluicing systems; sanitary wastes; and runoff from the coal-storage pile. These wastes will be collected and transported to retention and treatment ponds and then, after treatment, will be recycled for plant use or disposed of by spraying on land.

Liquid wastes from Unit 4 that will be discharged into Tampa Bay waters include condenser biocide additions, boiler blowdown, blowdown from the bottom-ash sluice system, and treated chloride bleed from the FGD system, all of which will be discharged into the discharge canal via the circulating-water discharge line, as well as roof and yard drainage, which will discharge into the intake and discharge canals.

It is estimated that solid-waste generation resulting from Unit 4 operation will total approximately 357,380 tons per year. Bottom ash, pyrites removed from the coal before combustion, economizer ash, and fly ash will be collected and sluiced to settling ponds; subsequently, the dewatered waste material will be disposed of in onsite disposal cells. Fly ash will be available for sale as future markets allow. High-quality gypsum (calcium sulfate) generated as byproduct of the operation of the Unit 4 FGD system will be handled and stored on the site. The storage of this gypsum will be either short- or long-term, depending on its marketability. Permanent disposal will include onsite landfilling of the residual material. Disposal sites will be designed and operated in accordance with applicable Federal and State regulations.

Coal pretreatment, boiler design features, and air-pollution-control devices will combine to ensure that the operation of the proposed unit complies with applicable air quality regulations. Particulate matter will be controlled with an electrostatic precipitator, which will be installed at the exit of the air preheater. Sulfur dioxide emissions will be minimized by a combination of procedures, including coal washing and tail-gas scrubbing in an FGD system. The formation of nitrogen oxides and carbon monoxide during combustion will be inhibited by the design and proper operation of the proposed boiler, furnace, and combustion air control system and by the operating procedures for this equipment.

The expansion of transmission facilities to accommodate Unit 4 will be limited to the installation of a new transmission circuit, which will use the existing towers and transmission routes. The addition of the circuit will not require additional land, additional clearing of vegetation, or changes in topography.

Table 2-4. Water use at Big Bend Station[a] (Sheet 1 of 3)
(Thousands of gallons per day)

Line number[b]	Use	Average use	Maximum use	Nature[c]	Duration	Frequency
A	Activated-carbon bed influent	145.2	145.2	C	--	--
B	Activated-carbon bed effluent	144.9	144.9	C	--	--
C	Activated-carbon bed backwash	0.3	0.3	I	--	1 per week
D	Anion/cation bed effluent	115.0	115.0	C	--	--
E	Anion/cation bed backwash	29.9	29.9	I	--	1 every 30 hours
F	Mixed-resin bed effluent (boiler makeup)	114.2	114.2	C	--	--
G	Mixed-resin bed backwash	0.8	0.8	I	--	1 every 27 days
H	Neutralization/equalization effluent backwash	38.7	38.7	C	--	--
I	Condensate-polisher backwash makeup	8.0	8.0	I	--	1 every 4 days
J	Condensate-polisher backwash	8.0	8.0	I	--	1 every 4 days
K	Boiler blowdown	43.2	43.2	C	--	--
L	Boiler chemical cleaning waste	0.9	0.9	I	2 hours per stage	1 every 2 years
M	Vent losses	15.0	15.0	C	--	--
N	Soot-blowing losses	47.1	47.1	I	--	--
O	Service cooling-water makeup	210.0	210.0	C	--	--
P	Service cooling-water evaporation losses	138.0	138.0	C	--	--
Q	Service cooling-tower blowdown	72.0	72.0	C	--	--
R	High- and low-pressure fire protection system	Nil	Nil	I	--	--
S	Domestic service water	1.3	1.3	I	--	--
T	Sewage-treatment plant effluent	1.3	1.3	I	--	--
U	Hose connection	0.1	2.9	I	4 hours	1 every 4 weeks
V	Pump seals	10.8	10.8	C	--	--
W	Clinker/grinder seals	1.3	5.4	I	2 hours	3 per day
X	Coal equipment wash	2.1	2.1	I	16 hours	4 per year
Y	FGD system makeup	1,123.2	1,123.2	C	--	--

Note: See abbreviations and footnotes at end of table.

Table 2-4. Water use at Big Bend Station[a] (Sheet 2 of 3)
(Thousands of gallons per day)

Line number[b]	Use	Average use	Maximum use	Nature[c]	Duration	Frequency
Z	FGD slurry (85% water)	1,741.0	1,741.0	C	--	--
AA	FGD evaporation losses	989.3	989.3	C	--	--
BB	Hydroclone effluent to filter	316.8	316.8	C	--	--
CC	Vacuum-filter sludge (20% water)	74.9	74.9	C	--	--
DD	Vacuum-filter recycle	241.9	241.9	C	--	--
EE	Hydroclone recycle	1,424.4	1,424.4	C	--	--
FF	Recycle to FGD system	1,607.1	1,607.1	C	--	--
GG	FGD system wash	66.6	133.3	I	--	--
HH	Service-water effluent	21.2	21.2	I	--	--
II	Wastewater-treatment system recycle	21.2	21.2	I	--	--
JJ	Air-preheater wash	9.4	9.4	I	8 hours	1 every 3 months
KK	Precipitator wash	5.3	5.3	I	80 hours	3 per year
LL	Economizer wash	0.3	0.3	I	4 hours	3 per year
MM	Sparging system	4.6	4.6	I	24 hours	3 per year
NN	External boiler wash	1.6	1.6	I	24 hours	2 per year
OO	Fly-ash pond blowdown	72.0	72.0	I	--	--
PP	Wastewater-treatment system percolation losses	30.0	30.0	C	--	--
QQ	Spray-irrigation system	169.5	183.4	I	--	--
RR	Construction runoff	0	0	I	--	--
SS	Condenser cooling water	347,072.0	347,072.0	C	--	--
TT	FGD system blowdown	59.0	59.0	C	--	--
UU	Bottom-ash pond makeup	505.0	505.0	C	--	--
VV	Condenser cooling effluent	347,072.0	347,072.0	C	--	--
WW	Coal-storage runoff	—	—	I	--	--
XX	Bottom-ash recycle	1,825.0	1,825.0	C	--	--
YY	Fly-ash sluice-water makeup	72.0	72.0	I	--	--

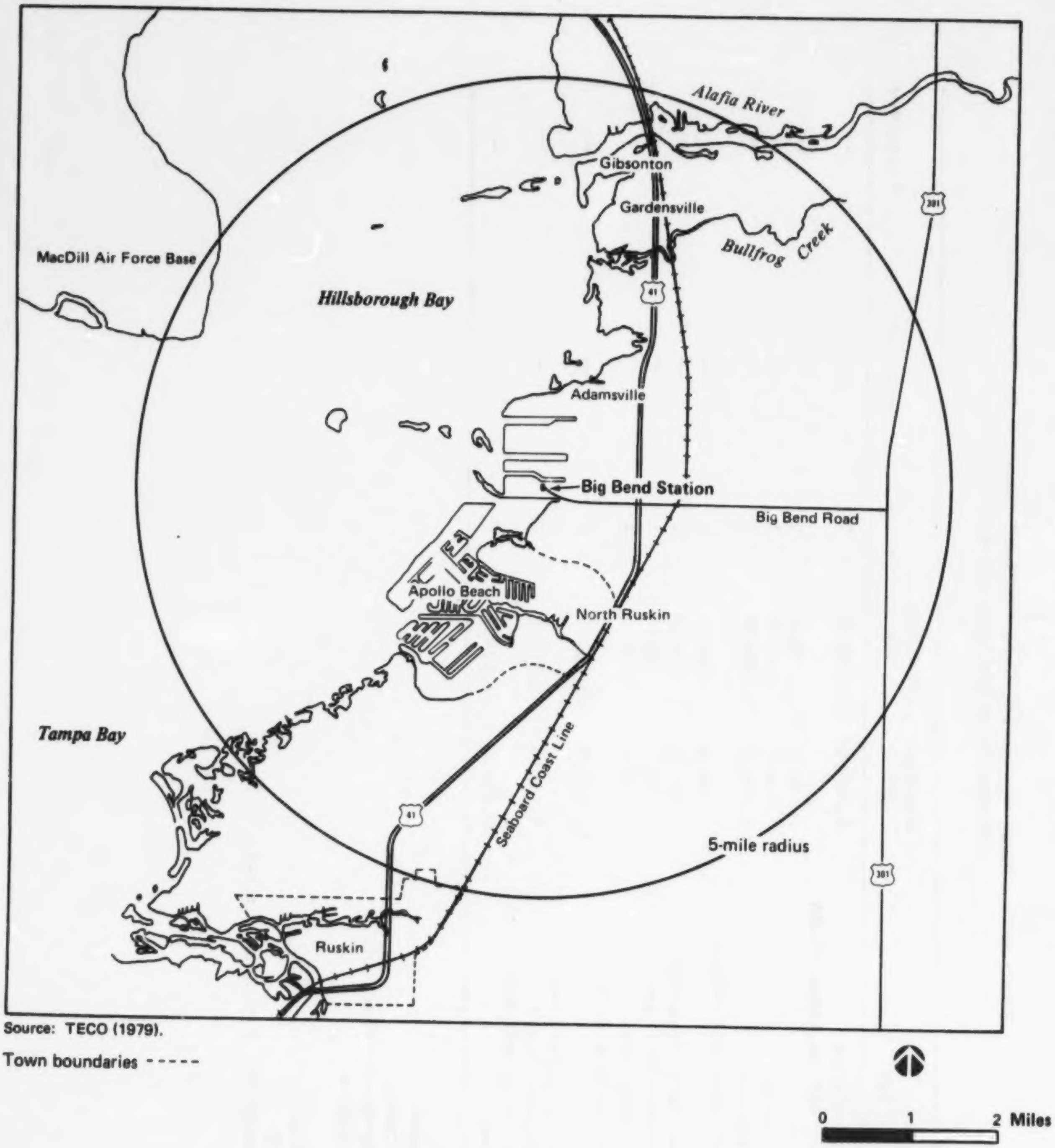
Note: See abbreviations and footnotes at end of table.

Table 2-4. Water use at Big Bend Station[a] (Sheet 3 of 3)
(Thousands of gallons per day)

Line number[b]	Use	Average use	Maximum use	Nature[c]	Duration	Frequency
AAA	Bottom-ash sluice	2,300.0	2,300.0	I	--	--
BBB	Bottom-ash system evaporation losses	30.0	30.0	C	--	--
CCC	Fly-ash sluice	1,440.0	1,440.0	I	--	--
DDD	Fly-ash recycle	1,368.0	1,368.0	I	--	--
EEE	Bottom-ash pond percolation losses	360.0	360.0	C	--	--
FFF	Bottom-ash pond blowdown	115.0	115.0	C	--	--
GGG	Construction water uses	NA	NA	I	--	--
HHH	Domestic water uses	NA	NA	I	--	--
III	Condenser cooling-water makeup	15,408.0	15,408.0	C	--	--
JJJ	Condenser cooling-tower evaporation losses	5,184.0	5,184.0	C	--	--
KKK	Condenser cooling-tower blowdown	10,224.0	10,224.0	C	--	--

Abbreviations:
C = continuous.
I = intermittent.
FGD = flue-gas-desulfurization.
NA = not available.

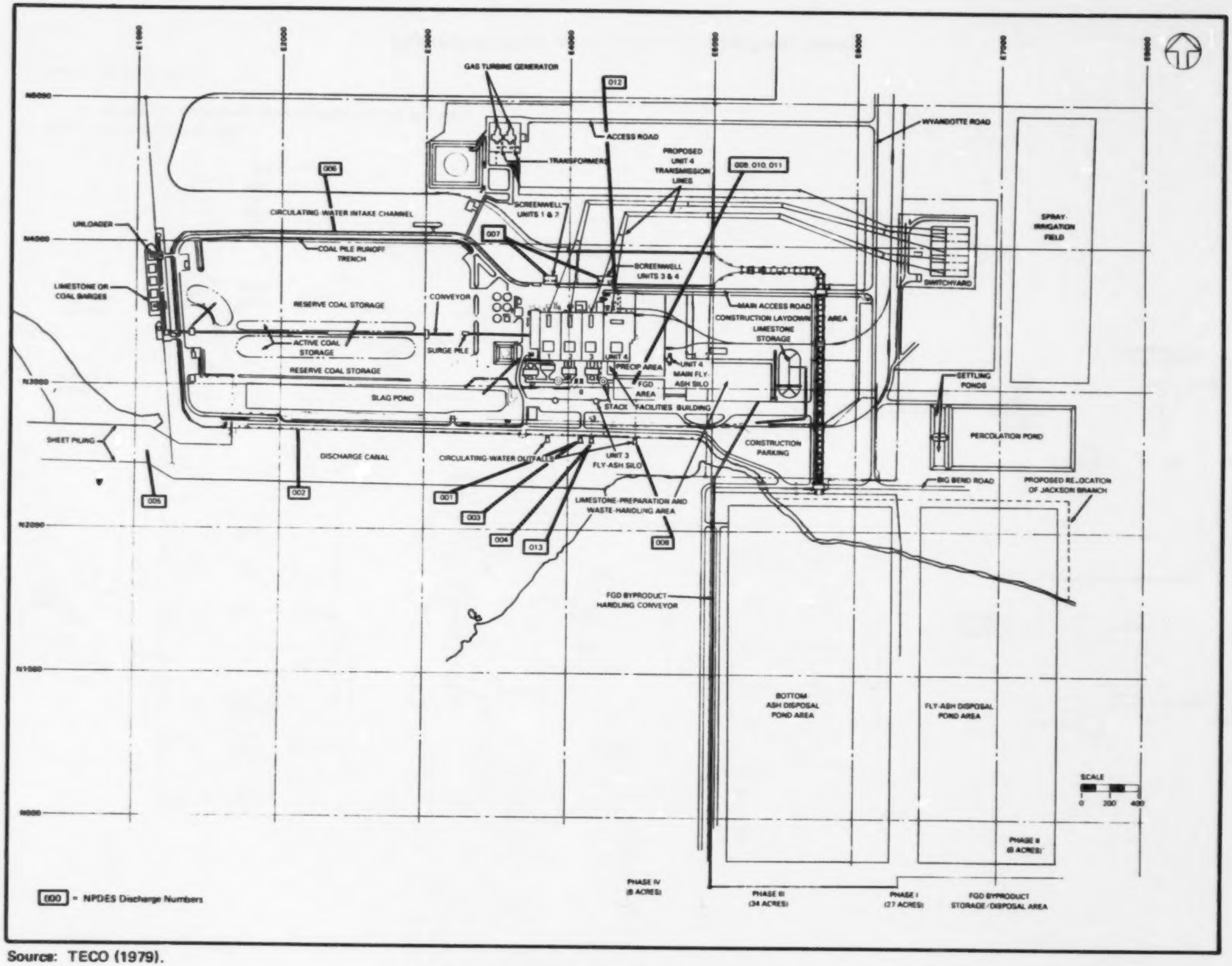
[a] From TECO (1981).
[b] See Figure 2-5.
[c] Key: C = continuous; I = intermittent.


Alafia River
Gibsonton
Gardensville
Bullfrog Creek
301
MacDill Air Force Base
Hillsborough Bay
41
Adamsville
Big Bend Station
Big Bend Road
Apollo Beach
North Ruskin
Tampa Bay
Seaboard Coast Line
41
5-mile radius
301
Ruskin
0
1
2 Miles

Source: TECO (1979).

Town boundaries - - - - -

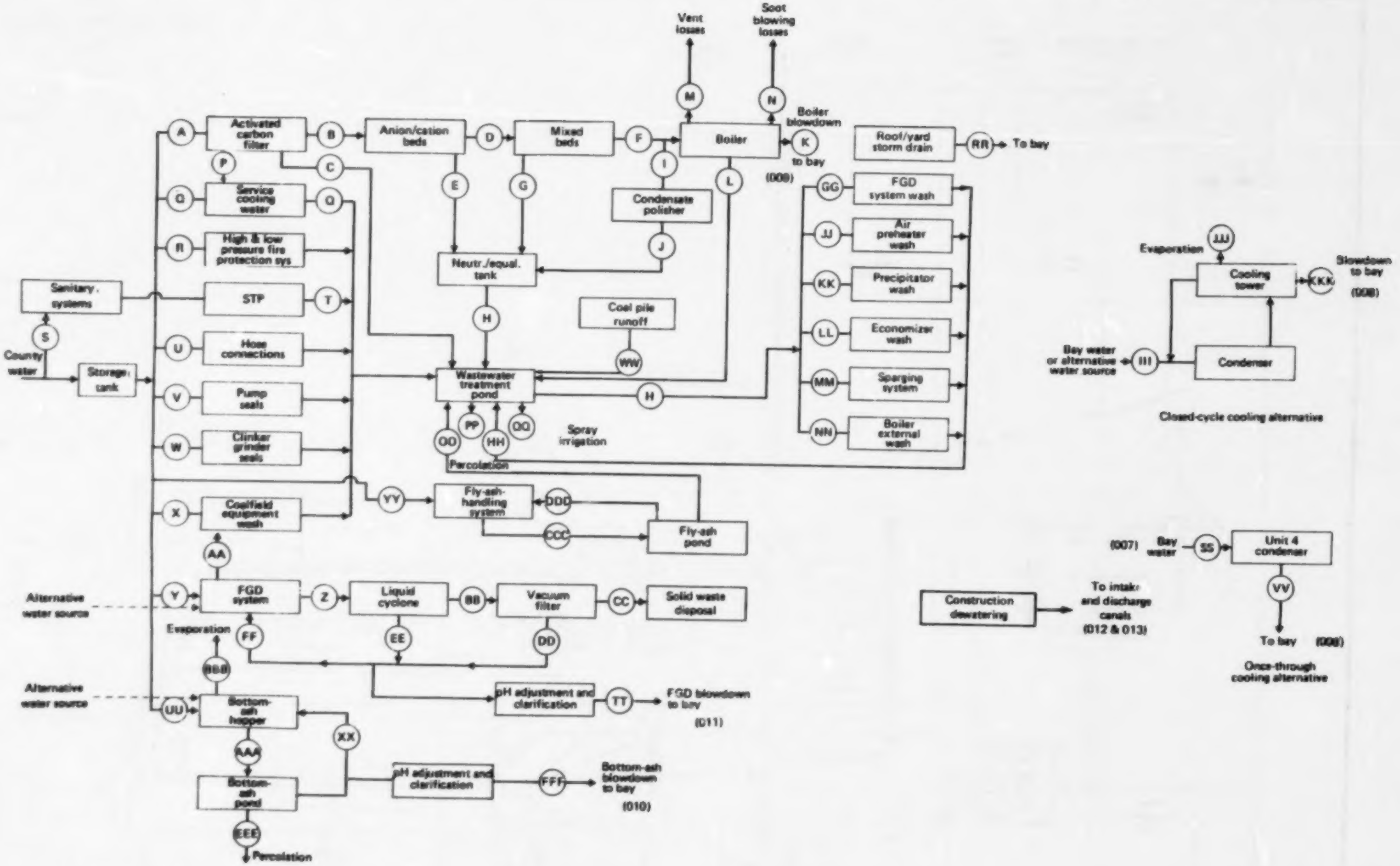
Figure 2-3. General location of the Big Bend site.



E1000
E2000
E3000
E4000
E5000
E6000
E7000
E8000
N5000
N4000
N3000
N2000
N1000
N000
GAS TURBINE GENERATOR
012
ACCESS ROAD
TRANSFORMERS
PROPOSED UNIT 4 TRANSMISSION LINES
009, 010, 011
WYANDOTTE ROAD
SPRAY-IRRIGATION FIELD
006
CIRCULATING-WATER INTAKE CHANNEL
SCREENWELL UNITS 1 & 2
007
UNLOADER
COAL PILE RUNOFF TRENCH
SCREENWELL UNITS 3 & 4
SWITCHYARD
LIMESTONE OR COAL BARGES
RESERVE COAL STORAGE
CONVEYOR
MAIN ACCESS ROAD
CONSTRUCTION LAYDOWN AREA
LIMESTONE STORAGE
ACTIVE COAL STORAGE
SURGE PILE
1
2
3
UNIT 4
PRECIP AREA
UNIT 4 MAIN FLY-ASH SILO
RESERVE COAL STORAGE
FGD AREA
SETTLING PONDS
SLAG POND
STACK
FACILITIES BUILDING
PERCOLATION POND
CONSTRUCTION PARKING
SHEET PILING
DISCHARGE CANAL
CIRCULATING-WATER OUTFALLS
UNIT 3 FLY-ASH SILO
BIG BEND ROAD
PROPOSED RELOCATION OF JACKSON BRANCH
005
002
001
003
004
013
LIMESTONE-PREPARATION AND WASTE-HANDLING AREA
008
FGD BYPRODUCT HANDLING CONVEYOR
BOTTOM ASH DISPOSAL POND AREA
FLY-ASH DISPOSAL POND AREA
SCALE
0
200
400
PHASE II (8 ACRES)
PHASE IV (8 ACRES)
PHASE III (34 ACRES)
PHASE I (27 ACRES)
FGD BYPRODUCT STORAGE/DISPOSAL AREA
000 = NPDES Discharge Numbers

Source: TECO (1979).

Figure 2-4. Plot plan, Big Bend Station.


Vent losses
Soot blowing losses
M
N
Boiler blowdown
K
to bay
(009)
A
Activated carbon filter
B
Anion/cation beds
D
Mixed beds
F
Boiler
Roof/yard storm drain
RR
To bay
P
C
E
G
I
L
Condensate polisher
J
Q
Service cooling water
R
High & low pressure fire protection sys
Neutr./equal. tank
Sanitary systems
STP
T
H
Coal pile runoff
S
County water
Storage tank
U
Hose connections
WW
Wastewater treatment pond
V
Pump seals
W
Clinker grinder seals
PP
OO
HH
QQ
Spray irrigation
Percolation
GG
FGD system wash
JJ
Air preheater wash
KK
Precipitator wash
LL
Economizer wash
MM
Sparging system
NN
Boiler external wash
Evaporation
JJJ
Cooling tower
KKK
Blowdown to bay
(008)
Bay water or alternative water source
III
Condenser
Closed-cycle cooling alternative
X
Coalfield equipment wash
YY
Fly-ash-handling system
DDD
CCC
Fly-ash pond
AA
(007)
Bay water
SS
Unit 4 condenser
VV
To bay
(008)
Once-through cooling alternative
Alternative water source
Y
FGD system
Z
Liquid cyclone
BB
Vacuum filter
CC
Solid waste disposal
Construction dewatering
To intake and discharge canals (012 & 013)
Evaporation
FF
EE
DD
BBB
pH adjustment and clarification
TT
FGD blowdown to bay
(011)
Alternative water source
UU
Bottom-ash hopper
XX
AAA
Bottom-ash pond
pH adjustment and clarification
FFF
Bottom-ash blowdown to bay
(010)
EEE
Percolation

Notes: See Table 2-4 for key.
Numbers in parentheses refer to NPDES Serial Numbers.

Source: TECO (1981).

Figure 2-5. Plant water balance for Big Bend Station.

2.6 ALTERNATIVE PLANT SYSTEMS

This section describes various alternative plant systems considered for Big Bend Unit 4. The discussion covers systems for waste-heat rejection, wastewater-treatment and control, the control of atmospheric pollution, the management of solid wastes, and the transmission right-of-way.

2.6.1 WASTE-HEAT-REJECTION SYSTEMS

One of the more critical decisions with respect to minimizing the potential environmental impacts of Unit 4 is the selection of the waste-heat-rejection system. There are two types of systems that are feasible for application in the present project: once-through cooling and cooling towers. Several different design alternatives of each type of system were examined carefully from the point of view of impacts on the site and its environs. Table 2-5 is a comparison of the principal potential impacts of each major alternative considered. This section presents a more detailed description of the alternatives.

TECO proposed that Big Bend Unit 4 use a once-through cooling system with conventional intake screens. After reviewing TECO's Section 316 Demonstration, the EPA concluded that the entrainment and impingement losses for Units 1-4 are potentially adverse (Appendix D). The EPA determined that the use of fine-mesh screens for Big Bend Units 3 and 4 will limit entrainment effects to approximately the current impacts of Units 1, 2, and 3 (see Section 3.3.3.4).

2.6.1.1 Once-Through Cooling with Fine-Mesh Screens on Units 3 and 4, No Dilution (Applicant's Proposed System)

By this alternative, Unit 4 will have a once-through cooling system, and a fine-mesh screen (aperture: 0.5 millimeter) will surround the 9.5-millimeter (3/8-inch) mesh traveling screens of Units 3 and 4. Unit 4 will have a condenser independent of Units 1, 2, and 3, and it will be cooled by water withdrawn from Hillsborough Bay via the existing intake channel. The intake structure will be in common with Unit 3. Figure 2-6 illustrates the cooling-water system of the existing three units and that proposed for Unit 4.

After passing through the Unit 4 condenser, the water will exit (NPDES Serial No. 008) to the existing discharge channel and combine with water discharged from Units 1, 2, and 3 (NPDES Serial Nos. 001, 003, and 004). The mixture will flow westerly, returning to Hillsborough Bay.

Unit 4 will draw approximately 537 cubic feet per second of circulating water from the existing, 25-foot-deep intake channel. Unit 4 will have a screenwell structure equipped with two circulating-water pumps with a capacity of 268.5 cubic feet per second, and each pump will have its own 9.5-millimeter (3/8-inch) mesh traveling-water screen similar to those on Units 1, 2, and 3. This traveling-screen structure and that for Unit 3 will be surrounded by a sheet-pile-wall forebay equipped with 0.5-millimeter-mesh traveling screens. The cooling water will be drawn through the 0.5-millimeter and 9.5-millimeter (3/8-inch) screens by the pumps supplying the Unit 3 and Unit 4 condensers. The average water velocity immediately in front of the 9.5-millimeter (3/8-inch) screenwell will be about 1.45 feet per second. Approach velocities to the 0.5-millimeter-mesh screens will be about 0.5 foot per second. Flows in the intake channel for the units, and their respective velocities, are given in Table 2-6.

As a result of EPA concern regarding the number of organisms entrained at Big Bend Station Units 1, 2, and 3, the Applicant initiated a multiphase evaluation of alternative intake technologies to identify potential design alternatives for the Unit 4 intake structure.

The evaluation consisted of several tasks:

1. Reviewing available intake technologies that might be applied to Big Bend Station to minimize entrainment losses
2. Selecting organism-protection systems that show promise of biological effectiveness and engineering reliability and conducting a more detailed site-specific evaluation of these systems
3. Initiating preliminary studies to evaluate the feasibility of the selected system
4. Conducting detailed studies to prove the effectiveness and reliability of the alternative system

The results of the first three tasks indicated that a fine-mesh screening system (specifically, a modified, dual-flow traveling screen) could reduce the loss of entrained organisms at Big Bend Station. Consequently, more detailed studies to further evaluate the fine-mesh screen concept were conducted during 1980.

The test results show that a fine-mesh screen system could reduce the entrainment losses at Big Bend by returning viable meroplankton organisms to the bay system. As a basis for ecological and engineering evaluations of the potential effectiveness of fine-mesh screening at Big Bend Station, a conceptual design for such a system was developed.

According to this design, fine-mesh screens will be applied to existing Unit 3 and proposed Unit 4. A layout of the new screening structure is shown in Figure 2-7. To screen the flow and protect the pumps and condenser during emergency operation, the existing coarse-mesh (9.5-millimeter) screens will be maintained on Unit 3 and similar coarse-mesh screens will be installed on Unit 4.

The number and size of the fine-mesh screens have been preliminarily determined on the basis of a standard screen-face velocity (approach velocity) of 0.5 foot per second at 0.0 mean low water. Low- and high-pressure sprays (5 to 10 pounds per square inch and 40 to 60 pounds per square inch, respectively) will wash organisms and debris into separate troughs. All troughs will manifold into a common sluiceway, and the combined flow will pass through a debris trap and a 4-inch-mesh screen. The flow will carry organisms and debris to a release point north of the intake channel via an 18-inch pipe (Figure 2-7). This design will maximize the opportunity for the survival of any organisms not removed by the low-pressure spray but subsequently removed by the debris spray.

The organism-return pipe will be sized to achieve a transport velocity of less than 5 feet per second. The pipe will run west along the south side of the intake channel to a footbridge, from which it will be supported as it traverses the channel. From this point, the pipe will take one of two possible routes. It will travel either west, north, and east, or simply north and east to a channel where it will discharge. While the first route would be longer, it would avoid road crossings, which require buried pipe sections, and thus may be more suitable from biological and engineering standpoints. The length of the return pipe will range from 1500 to 4700 feet, depending on the exact routing and location of discharge in the channel.

To alleviate fouling problems, there will be two pipes. With this arrangement, the flow could be frequently diverted from one pipe to the other, and the unused pipe could be drained and dried. Each pipe will be cleaned with a pressure-driven "pig."

As a part of the conceptual design evaluation, cost estimates were developed for installing fine-mesh screens at Big Bend Units 3 and 4. Costs were also estimated for a duplicate system that could be installed on Units 1 and 2 if further reduction in entrainment were required. The cost of the organism-return pipe, which would be shared by all four units if equipped with fine-mesh screens, was included only in the cost for Units 3 and 4. These costs were compared to the differential costs (costs over and above the costs of a conventional once-through system) of a closed-cycle cooling system. Table 2-7 provides a summary of this cost comparison. The closed-cycle cooling system that was used for comparison is a mechanical-draft cooling tower (Section 2.6.1.5).

In the once-through cooling system, pipes from the Unit 4 condenser will connect to a 9-foot-diameter pipe leading to the discharge structure. The Unit 4 discharge structure will resemble those for Units 1, 2, and 3 (Figure 2-8). The warm circulating water from Unit 4 will also exit to the discharge channel. The structure, designed to reduce the velocity of the discharged water, will control erosion of the far bank of the dredged discharge channel. Flow from the Unit 4 discharge structure will combine with the discharge water from the three existing units and move westerly through the channel to the point of discharge to Tampa Bay. Flows in the discharge channel and their respective velocities are presented in Table 2-6. The characteristics of the thermal plume produced by Units 1-4 are described in Section 3.3.13.

Big Bend Units 1, 2, and 3 are equipped with one chlorinator, to which Unit 4 will be connected. Liquid chlorine will be fed to the Unit 4 cooling water at a similar rate and in the same manner that it is being fed to the existing units.

The chlorine for Unit 4 will be injected for 20 minutes three times a day. Only one unit at a time will be chlorinated. The feed rate is expected to range from 5000 to 8000 pounds per day, with an average feed rate of 6000 pounds per day. It is currently proposed that total residual oxidant (total residual chlorine in salt water) levels at the discharge be limited to 0.2 milligram per liter. This matter is currently under review by the EPA and the Florida Department of Environmental Regulation.

The use of a fine-mesh screening system on the intakes of Units 3 and 4 will limit organism entrainment to approximately the rates occurring with the use of conventional 9.5-millimeter (3/8-inch) mesh screens alone on Units 1-3 without thermal-dilution cooling. Organisms removed from the cooling water by the fine-mesh screens will not experience the effects of passage through the condenser-cooling system, but instead will be exposed to the effects of impingement on the screen and subsequent return, via a sluiceway, to local waters.

2.6.1.2 Once-Through Cooling with Fine-Mesh Screens on Units 1-4, No Dilution

This alternative consists of equipping existing Units 1, 2, and 3 and new Unit 4 with the fine-mesh screen system. However, not all of the potential engineering problems with this alternative have been resolved. With this alternative, organism-entrainment levels will be further reduced below those occurring with a conventional once-through system. Economic costs for this alternative are detailed in Table 2-7.

2.6.1.3 Once-Through Cooling with Conventional Screens, No Dilution

With this alternative, cooling water for Unit 4 is drawn from the intake channel at the rate of 537 cubic feet per second. Water velocity approaching the screens is about 1.5 feet per second. The water passes through a debris fence and conventional (coarse-mesh) traveling screens to the screenwell. From the screenwell it is pumped through the condenser and then flows to the discharge point south of the unit.

The discharge flow mixes with the discharges from the existing units before re-entering Hillsborough Bay. The design temperature rise of the water passing through the Unit 4 condenser is 16.8°F at 100 percent load.

By this alternative, as opposed to the use of a fine-mesh screen system, entrained organisms would be subjected to the effects of passage through the condenser-cooling system. Moreover, organisms impinged on the 9.5-millimeter (3/8-inch) mesh screens would not be returned to local waters, but would be disposed of as waste.

The EPA stated in the Finding and Determination for the Section 316 Demonstration for Units 1-4 (Appendix D) that TECO's analysis failed to demonstrate that conventional once-through cooling would adequately minimize entrainment impacts. It was also estimated that the addition of a fourth conventional once-through cooling system to the existing facilities could increase the current impingement effects of Units 1, 2, and 3 by approximately 33 percent. The EPA concluded that entrainment and impingement losses for four Big Bend units using conventional screens are potentially adverse.

2.6.1.4 Once-Through Cooling with Dilution

This option is the same as the once-through alternatives described above, except for the addition of a flow of ambient unheated water into the discharge canal in order to reduce the temperature of the effluent before it enters Hillsborough Bay. This system could be activated for use with Units 1-4. The arrangement of the system is shown in Figure 2-9. There are two pumps in the existing arrangement, each with a capacity of 890 cubic feet per second. The intake to the pumps is provided with a trash rack to remove large debris. The low speed and large clearances within the pump allow fish to pass through with a minimum of injury. Water at ambient temperature is withdrawn by the pumps from the intake side of the site and released into the discharge stream. The resulting dilution lowers the temperature of the effluent. The temperature reduction is dependent on the volume of water passed through the dilution pumps.

A dilution system for Units 1-4 could utilize either one or two pumps. With all four units at full load, the dilution effect from one pump would reduce the temperature rise from intake to discharge from about 16.8°F to about 11.8°F. A reduction to about 9.2°F would be achieved with two dilution pumps in operation. The use of a two-pump system would require some modification to the existing arrangement at the site, including the possible addition of a third pump as a backup.

Mixing with ambient water would decrease the temperature of the thermal plume in the discharge canal. The overall plume would have a larger areal extent, but the area within the highest isotherms would be smaller, and thus potentially there would be a thermal impact on fewer organisms.

Organism entrainment and its effects would be greater with this alternative than with once-through systems with no dilution because plankton in the dilution water would be exposed to elevated temperatures as this water mixed with the heated effluent in the discharge canal. The increase in the numbers of organisms entrained would be directly proportional to the volume of water used for dilution.

The EPA has stated in the Finding and Determination on the Section 316 Demonstration for Units 1-3 that entrainment levels were unacceptably high when dilution pumping was used in conjunction with the operation of three units at Big Bend (see Appendix C).

2.6.1.5 Mechanical-Draft Wet-Cooling Towers with Saltwater Makeup

Figure 2-10 shows the flow path of the condenser-cooling water for this alternative. Water flows in a closed loop between the cooling tower and the condenser. As it passes through the condenser, it absorbs waste heat from the power-generating cycle. The heated water then flows to the top of the cooling tower, and from there it is sprayed down through the tower to a collection basin at the bottom. The water from the basin is then pumped back to the condenser, completing the circuit. Large fans at the top of the tower draw air through it and exhaust the air upward from the top. The water falling downward through the air stream is cooled by evaporation.

A cooling tower of this type would have the shape of a portion of a cone. It would have a diameter of 265 feet at the bottom and 285 feet at the top deck. It would be 70 feet high and have 13 fans, each of 175 horsepower. Because the tower cools by evaporating some of the water flowing through, makeup water must be added to replace it. Salt or minerals in the makeup tend to concentrate in the cooling-tower water since evaporation removes only pure water, leaving other constituents behind. To control their concentration, a portion of the water circulating in the tower system is discharged as "blowdown," and the makeup is increased by a corresponding amount. In the case of the Big Bend Unit 4 tower, makeup (from Tampa Bay) would have an average salinity of 28 parts per thousand, and the design salinity in the water circulating in the tower would be 1.5 times that level, or 42 parts per thousand. Makeup water would be taken through a makeup-intake structure located either adjacent to the Unit 3 circulating-water intake or in the discharge canal. Blowdown would be discharged to the discharge canal.

During operation of the cooling tower, droplets of circulating water (drift) are entrained in the air flowing through the tower and are exhausted in the air stream leaving the top of the tower. The drift contains dissolved solids that are present in the circulating water--primarily salt in the case of Big Bend Unit 4. Drift eventually is deposited on soils, vegetation, structures, etc., with potentially harmful effects. Cooling towers are equipped with drift eliminators, but, while they are capable of substantially reducing drift, they cannot eliminate it altogether. Cooling-tower manufacturers are currently offering guarantees that the drift rates will not exceed 0.002 percent of the circulating-water flow. It is probably technically feasible to reduce drift rates still further by using larger fill areas and larger and more elaborate drift eliminators, but only at the expense of increased fan power to move the air through the tower as well as increased tower size and cost.

Important environmental considerations relative to the use of this alternative heat-rejection system include (1) the effects of salt drift on local air, land, and equipment; (2) the increased fogging potential and noise levels; (3) the potential for aesthetic impacts; (4) potential impacts on surface-water quality due to the discharge of tower blowdown; (5) the very small impact of impingement and entrainment; and (6) the small thermal discharge to Hillsborough Bay.

A closed-cycle system for Big Bend Unit 4 will be substantially more expensive than the proposed once-through system. In terms of capital cost, the mechanical-draft system represents an incremental cost of about $26 million at the time of commercial operation. There is also a performance penalty of approximately $1.9 million per year. The net present value of the annual capital and performance costs of the mechanical-draft system is about $6.1 million more than that of the once-through system.

2.6.1.6 Mechanical-Draft Wet-Cooling Towers with Treated-Wastewater Makeup

This alternative would be similar in concept to the preceding alternative, but some differences would result from the different characteristics of the makeup water. The reduced content of dissolved solids would allow for a higher concentration factor (ratio of solids in the circulating water to solids in the makeup water) and higher drift rates. The circulating-water flow and heat-dissipation rates would not be different from those of a tower system designed for saltwater makeup. However, the blowdown rate could be reduced by about 10 times. Less elaborate and hence less costly drift eliminators would be required.

The required makeup rate would be about 4300 gallons per minute (about 6.2 million gallons per day) with the unit operating at maximum output.

There would be no impingement or entrainment with this alternative, since no water would be withdrawn from Hillsborough Bay.

As discussed in the section on alternative sites, treated wastewater is available in suitable quantities near certain alternative sites that were considered. However, there is no supply within several miles of the Big Bend site. Thus, a large pipeline several miles in length would be required to transport the makeup water to the site. The cost of such a pipeline makes this system an expensive alternative.

2.6.1.7 Other Alternative Systems

Natural-Draft Cooling Towers

TECO commissioned a study to determine the preferred type of closed-cycle heat-rejection system for Big Bend Unit 4. The closed-cycle systems considered in the study were a natural-draft cooling tower and a concrete, circular mechanical-draft cooling tower with multiple fans.

The mechanical-draft cooling-tower system was selected primarily on the basis of economics. The net present value of the capital and performance costs associated with the natural-draft closed-cycle system was estimated to be approximately $22 million more than those of the mechanical-draft system. The net present value was computed by discounting annual capital and performance costs over an economic life of 28 years using a cost of capital of 8.62 percent. The higher net present value for the natural-draft system results from its significantly higher capital cost; the total capital cost of the system at the time of commercial operation, including escalation and interest during construction, is approximately $17 million more than that of the mechanical-draft system. Although there is a performance advantage for the natural-draft system of approximately $400,000 per year, this does not offset the high capital differential.

The natural-draft tower does not offer any significant environmental advantages that would outweigh its greater cost. The natural-draft tower was judged to be slightly preferable to the mechanical-draft tower in terms of salt-drift impacts, ground-fogging potential, and noise, but less desirable with respect to aesthetic impacts. Impingement and entrainment effects would be the same for this alternative as for mechanical-draft towers with salt-water makeup.

Cooling Towers with Brackish-Water Makeup

A ground-water investigation was performed to evaluate the availability of brackish artesian water as an alternative source of makeup water. Approximately 5000 to 7000 gallons per minute of makeup water with total dissolved solids at less than 20,000 parts per million and with temperatures of less than 90°F would be required. The investigation focused on whether or not the withdrawal of brackish water from the deep artesian aquifers would be detrimental to the environment, particularly with respect to the existing quality and potentiometric surface of freshwater stored in the shallower artesian aquifers. These shallower aquifers have been used extensively for land irrigation and for industrial, commercial, and domestic water supply in a broad area adjacent to the plant site.

Preliminary indications are that brackish makeup water that meets and exceeds quality, quantity, and environmental requirements can probably be supplied from an approximate depth of 2000 to 3000 feet. In line with these indications, efforts were made (1) to assess the attitudes and regulatory requirements concerning the use of brackish water and (2) to gather extensive, site-specific hydrogeologic data from the original documentation of various well boring and testing programs, as well as background data from previous studies performed at Big Bend Station.

If the need for a brackish-water cooling-tower makeup source is indicated, an additional study program will be required. This program would consist of (1) the development of a computer model to simulate well-field and aquifer responses for the 35-year life of the station and (2) a field-testing program that will include the construction of a production test well and several test wells. On completion of this study, conclusions can be drawn as to the feasibility of using the brackish-water source, and the environmental effects of pumping the aquifer can be predicted.

Cooling Towers with Freshwater Makeup

The freshwater resources in the Big Bend area are limited to ground water that is used for agricultural activities. The quantities of water needed to supply a closed-cycle system would place a great burden on the local groundwater resources. For this reason, investigative efforts have concentrated on finding a feasible source of sewage effluent.

Dry-Cooling Towers

Dry-cooling towers have been used in those very few instances when water for power-plant cooling was scarce or unavailable. In this type of system, the water to be cooled is contained inside tubes, and air passes over the outside. The tubes are usually finned to promote heat transfer. Heat transfer, however, is much less desirable than evaporative cooling, since it results in high waste-heat-rejection temperatures and low overall plant efficiency. Therefore, this alternative was rejected.

2.6.2 WASTEWATER TREATMENT AND DISPOSAL ALTERNATIVES

This section discusses the various types of wastewater that will be generated at Big Bend Unit 4, their treatment, and their disposal. It also describes alternative treatment systems that have been considered by the Applicant.

2.6.2.1 Description of Wastewaters

The liquid wastes generated by the operation of Big Bend Unit 4 will consist of the following:

- Water-treatment and condensate-polisher wastes
- Wastes from equipment washing and boiler chemical cleaning
- Floor and equipment drainage
- Boiler blowdown
- Blowdown from the service-water cooling-tower system
- Blowdown from the bottom-ash-sluice system
- Wastes from fly-ash, economizer-ash, and pyrites sluicing
- FGD system chloride bleed stream

- Runoff from the coal-storage pile
- Sanitary wastes

All of these wastes are freshwater wastes. Unlike Units 1, 2, and 3, Unit 4 will not generate any saltwater waste streams.

Water-Treatment Wastes

The makeup-water-treatment system consists of activated-carbon filters; cation, anion, and mixed-bed demineralizers; and a forced-draft decarbonator. In addition, a condensate polisher will be used for further treatment of the condenser water.

The activated-carbon filters are automatically backwashed when the pressure drop across the bed reaches a predetermined value. Backwashing removes small quantities of suspended matter and reclassifies the activated carbon bed. The effluent from backwashing will be conveyed to the Unit 1 washwater sump for transport to the wastewater-treatment system.

The ion-exchange demineralizers will be regenerated with sulfuric acid for the cation resins and caustic soda for the anion resins. Wastes from the regeneration of the cation and anion demineralizers, the mixed-bed demineralizers, and the condensate polishers will be pumped to the 230,000-gallon waste-neutralization tank to equalize and thus partially neutralize the spent acid and caustic. The exchangers will be regenerated every 24 hours under maximum load, resulting in approximately 112,000 gallons of waste. The mixed-bed demineralizers will be regenerated approximately every 20 days, resulting in approximately 30,000 gallons of waste, and the condensate polishers will be regenerated approximately once per month, resulting in approximately 60,000 gallons of waste. These wastes will be transported to the wastewater-treatment system.

The regeneration waste from the condensate polisher/demineralizer will contain suspended and dissolved solids such as sodium chloride, sodium sulfate, and either ammonium sulfate or calcium sulfate. The quantities and concentrations of these wastes will depend on the manufacturer and/or the system purchased. The regeneration wastes will flow to the Unit 1 washwater sump and will then be pumped into the wastewater-treatment system.

Equipment Washing and Boiler Chemical Cleaning

The accumulation of deposits on equipment surfaces will necessitate washing the air preheaters, economizers, and precipitators every 12 to 26 weeks with the recycle-wash-system water. The air preheaters will be washed at a maximum flow rate of 2140 gallons per minute; the economizers and precipitators will be washed at a flow rate of 50 and 400 gallons per minute, respectively. The spent washwater will contain soluble metals (principally iron) and will have a pH between 1.4 and 4.0.

Chemical cleaning of the boiler and preboiler system before startup is necessary to provide clean, properly conditioned heat-transfer surfaces and thus to ensure reliable unit operation.

Postoperational chemical cleaning of the boiler will occur approximately every 2 years. Equipment washwaters will be pumped from the washwater sumps and disposed of in the wastewater-treatment system.

Floor and Equipment Drainage

Floor and equipment drainage will be collected and conveyed to the wastewater-treatment ponds. Drainage from the diked fuel-oil-storage areas and fuel-oil pumphouse will be conveyed to an oil separator. Oil-free water from the separator will be discharged into the intake channel. Collected oil will be drummed for reuse.

Boiler Blowdown

During normal station operation, approximately 30 gallons per minute of water will be blown down continuously from the steam drum and replaced with demineralized water. Blowdown is required to maintain total-dissolved-solids and silica levels below 50 parts per million and 10 parts per billion, respectively, to ensure reliable boiler operation. Small quantities of aqua ammonia and hydrazine are used both to control system pH in the boiler system and to remove trace quantities of dissolved oxygen in the preboiler system. Boiler blowdown (NPDES Serial No. 009) will flow to the Unit 4 condenser-cooling-water discharge pipe (NPDES Serial No. 008), which discharges into the station discharge canal.

Blowdown from the Service-Water Cooling Tower

Well water from Hillsborough County will be used as makeup to a wet-evaporative mechanical-draft cooling tower serving heat exchangers such as turbine lubrication-oil coolers and bearing-water coolers. Small quantities of sulfuric acid will be added to the recirculating water to control calcium carbonate scaling by reducing the bicarbonate alkalinity. Blowdown from the cooling tower will be required to keep dissolved solids at levels that are consistent with reliable operation. Approximately 50 gallons per minute of water will be continuously blown down from the tower and discharged into the washwater sump before being pumped to the wastewater-treatment system.

Blowdown from the Bottom-Ash-Sluice System

The boiler for Unit 4 will be of the dry-bottom type and will be provided with a freshwater-eductor system to transport ash to the bottom-ash pond. In order to maintain the correct water chemistry in the system, a blowdown will be required. The blowdown flow rate will be about 5 percent of the system flow rate, and the blowdown will be discharged (NPDES Serial No. 010) into the Unit 4 condenser-cooling-water discharge pipe (NPDES Serial No. 008), which discharges into the station discharge canal.

Wastes from Fly-Ash, Economizer-Ash, and Pyrites Sluicing

In order to control scaling in the sluice system, 5 percent of the sluice flow is expected to be blown down to the existing plant wastewater-treatment ponds.

FGD System Chloride Bleed Stream

During the operation of the FGD system, chlorides will become concentrated in the liquid in the quencher/prescrubber loop and throughout the waste-handling system. To prevent corrosion in the loop and to allow for the production of a commercial grade of gypsum, it is necessary to provide a blowdown, either intermittent or continuous. This blowdown, also referred to as the FGD system chloride bleed stream, is discharged into the station discharge canal. Its treatment before discharge is discussed in Section 2.6.2.2.

Runoff from Materials-Storage Piles

The coal to be used at Big Bend Unit 4 will be stored in the existing coal-storage pile, which will be expanded. This will be the only materials-storage pile that will be exposed to precipitation and subject to runoff.

Another storage pile will be used at Big Bend Unit 4: the pile of limestone for the FGD system. This pile, however, will be enclosed by a building and will therefore generate no runoff.

Sanitary Wastes

Sanitary wastes will be collected and conveyed to a package-sewage-treatment plant, described in more detail in Section 2.6.2.2, for ultimate discharge to the wastewater-treatment ponds.

2.6.2.2 Treatment and Disposal Systems (Applicant's Proposed Systems)

Big Bend Unit 4 will use three separate systems for the treatment and disposal of liquid wastes: a wastewater-treatment system, a system for treating the FGD chloride bleed stream, and a sewage-treatment plant for sanitary wastes. Also discussed in this section is the management of runoff from the coal pile.

Any wastes that are discharged to the wastewater-treatment system will be recycled or disposed of by evaporation/percolation or spray irrigation, with no point-source discharge to waters of the United States.

Wastewater-Treatment System

A wastewater-treatment system was installed during 1976 and 1977 to comply with the provisions of the NPDES permit issued by the EPA on March 31, 1976. The system now serves Units 1, 2, and 3 and is adequately sized to receive the wastes from the proposed Unit 4.

This system will be used for all in-plant waste streams produced by the proposed Unit 4 other than boiler blowdown, blowdown from the bottom-ash-sluice system, and the FGD chloride bleed stream. The wastes destined for this system will be captured by the in-plant collection system. This system consists of a network of sumps and piping throughout the plant area that receives wastewater from washing operations, equipment drains, etc., and conveys it to the main transfer sump. The mixture of wastewaters is then conveyed to the wastewater-treatment ponds.

Consideration is being given to a future refinement of the system, specifically, the isolation of intermittent waste streams, such as those from equipment washing and boiler chemical cleaning. This would be done in the interest of preserving water quality in the holding pond. These waters will be ultimately recycled for equipment washing or disposed of by spray irrigation.

Wastewater-Treatment Ponds. The wastewater is pumped from the main transfer sump through two parallel fiberglass-reinforced pipe (FRP) wastewater pipelines to the ponds about 2000 feet to the east. The arrangement combines the flow from the two pipelines and permits discharge into either one or both of the settling basins. The wastewater enters the settling basins through an FRP multiport-flow distribution manifold 12 inches in diameter. A major portion of the suspended solids settle out, forming a sludge layer in the basin that must be removed periodically. The clarified wastewater is transferred from each settling basin to the retention pond by submerged transfer pipes leading to the settling-basin effluent structures. Each of the effluent structures consists of a concrete sump, inlet and outlet piping, and a 90-degree V-notch weir.

At this time, treatment of the wastewater is limited to sedimentation in the settling basins and self-neutralization within the system of ponds. Each settling pond is approximately 200 feet long and 50 feet wide. The retention pond is approximately 900 feet long and 450 feet wide, has a volume of approximately 25 million gallons at a pond elevation of 11 feet, and has retention times on the order of 20 to 40 days. This large volume provides for the neutralization of the individual acidic and basic waste streams. Each settling basin has a design volume of approximately 456,300 gallons, resulting in a retention time of approximately 19 hours at the design average daily flow of 400 gallons per minute per basin. Operations records indicate flows on the order of 500 to 700 gallons per minute, with peaks as high as 2800 gallons per minute.

Three pipes are presently capable of discharging water from the pond; two are valved drain pipes and the third is an unvalved overflow pipe. TECO proposes installing a valve on the overflow pipe and locking all three of the valves. Keys will be given only to selected supervisory personnel.

TECO will also install an alarm system to signal high water levels in the pond. Should levels become dangerously high, excess water will be pumped to the spray-irrigation fields. If for emergency reasons any of the valves are opened to discharge water from the pond, a report will be sent to the EPA giving the reason why the valve was opened, the estimated volume of water discharged, the time of the discharge, and an analysis of the water sampled during discharge.

Recycle System. The wastewater-recycle system provides for the transfer of water from the wastewater-retention pond to a 500,000-gallon storage tank located at the plant. Wastewater is then reused for various washing and maintenance operations. Valving is provided in the recycle pipeline to allow the discharge of the wastewater from the retention pond into the ash-settling canal.

Table 2-8 lists the plant operations that are expected to use the recycled wastewater and their respective water requirements.

Spray-Irrigation System. The spray-irrigation system provides for the disposal of that portion of the wastewater within the retention pond in excess of the demand for recycled wastewater at the plant. The spray-irrigation site consists of approximately 29 acres of land lying within the transmission right-of-way directly north of, and adjacent to, the retention pond, as shown in Figure 2-11. Approximately 21.1 acres are actually irrigated, and the remainder constitute the nonirrigated buffer zone. The site consists of four separate irrigation plots of approximately 5.25 acres each. Wastewater from the retention pond is applied as required to one irrigation plot per day on a rotation basis. Irrigation is by means of a fixed system of four impact sprinklers per plot. Plot rotation is accomplished manually through the actuation of the 6-inch butterfly valves located on each of the laterals leading to the four irrigation plots.

As a practical matter, the application rate is governed by pond level, seasonal conditions, and ground-water level. The overriding criterion for system operation is the avoidance of runoff from the sprayed area. When runoff is not a limiting condition, application rates of 2 to 4 inches per week are considered. For a rate of 2 inches per week, each of the four plots must be sprayed 2 hours per day; for a rate of 4 inches per week, each plot must be sprayed 4 hours per day. This provides for a water-disposal capacity ranging from 254,400 to 508,800 gallons per day. An 8-inch propeller flowmeter in the pump-discharge manifold measures the total quantity of wastewater disposed of by spray irrigation.

Coal-Pile Runoff

The present system for the collection and treatment of coal-pile runoff consists of an interception trench, a pumping station, and a runoff pond. It is designed to capture and retain runoff resulting from the "design" storm established by the EPA. The design storm is defined as a 24-hour storm with a recurrence interval of 10 years. Runoff resulting from storms in excess of these design conditions is discharged into the plant intake canal (NPDES Serial No. 006).

To allow for Unit 4 coal storage, the coal-pile-runoff pond will be eliminated. The existing interception trench will be expanded to encircle the new coal-storage area and the pumping station will be relocated (Figure 2-12). According to the preliminary design made by TECO, 2500 feet of the existing trench bordering the south and a portion of the eastern coal-pile perimeter will continue to be used. The cross-sectional area of the trench is 45 square feet with a 20-foot top width and 2H to 1V side slopes. A new portion of trench enclosing the northern end and portions of the eastern and western ends of the coal pile will be 2200 feet long. This new trench will have a cross-sectional area of 72 square feet with a top width of 30 feet and 2H to 1V side slopes. The configuration of the new coal-pile-runoff trench will provide the same storage volume per area as the existing system. The pumping capacity will be designed to handle all surface runoff. The modified system will intercept all surface runoff, including that in excess of the 10-year 24-hour storm, and pump it to the wastewater pond.

Sanitary Sewage Treatment

Wastewater from all station sanitary fixtures is collected and conveyed to an existing package-sewage-treatment plant. This plant, which uses the extended-aeration aerobic-digestion process, was sized to accommodate future enlargements of the station. The plant has a capacity of 4500 gallons per day of domestic sewage, representing an influent 5-day biological oxygen demand (BOD) of 9 pounds per day based on a 24-hour runoff and a maximum flow rate of 9.6 gallons per minute.

Effluent from the treatment plant is disinfected with chlorine and then discharged into the plant wastewater-treatment system for ultimate disposal through spray irrigation.

Manpower projections for the operation and maintenance of Big Bend Unit 4 indicate that a second package-sewage-treatment plant will be required. This new plant will provide secondary treatment with design removal efficiencies of 90 percent for BOD and suspended solids. The effluent from the new plant will be chlorinated and discharged into the plant wastewater system. No sanitary wastes will be directly discharged to waters of the United States.

Treatment of the FGD-System Chloride-Bleed Stream

The FGD-system chloride-bleed stream will be treated for total suspended solids, pH, and oil and grease in a skid-mounted liquid-waste treatment system. The flow will enter a primary sedimentation tank that includes a polymer-feed system, where the majority of solids will settle. The type of polymer, which will be used as a coagulant aid, will be determined once the system is in operation. The system has been designed to handle flow rates of up to 70 gallons per minute. After the sedimentation tank, the waste-stream pH will be checked and adjusted to a value between 6.5 and 7.0 by adding either sodium hydroxide or sulfuric acid. The waste stream will then enter a clarifier for final effluent polishing before discharge. After treatment, the flow (NPDES Serial No. 011) will be discharged into the Unit 4 condenser-cooling-water-discharge pipe (NPDES Serial No. 008), which discharges into the station discharge canal. Sludge from the sedimentation tank and clarifier will be disposed of in the gypsum storage and disposal area.

2.6.2.3 Alternative Treatment Systems

Two alternative methods of treating the FGD-system chloride-bleed stream, boiler blowdown, and bottom-ash blowdown to meet water-quality criteria before mixing have been evaluated by the Applicant: the use of reverse osmosis and the treatment of the boiler and bottom-ash blowdowns in the treatment system provided for the FGD-chloride-bleed stream.

Reverse Osmosis

TECO's analysis indicates that it would not be practicable to use reverse osmosis to treat the indicated waste streams. The boiler and bottom-ash blowdown streams are projected to have total-dissolved-solids concentrations at or below 500 parts per million. These concentrations are considered to be below acceptable levels for the optimum operation of a reverse-osmosis system. In the FGD chloride bleed stream, the total-dissolved-solids concentration is projected to be approximately 108,000 parts per million. The treatment of such a concentration would require reverse-osmosis membranes capable of withstanding pressures in excess of 2000 pounds per square inch, which is beyond the capability of standard reverse-osmosis systems. Moreover, the chemical constituents of the FGD bleed stream could cause scaling of the membrane.

The Applicant also states that reverse-osmosis treatment would not produce a measurable improvement in the water quality of the effluent at the point of discharge. Accordingly, TECO believes that the estimated $1.8 million cost of the system would not be justified, since no detectable benefit in water quality would result.

Use of the FGD-Bleed-Stream-Treatment System

The FGD-bleed-stream-treatment system is designed for the removal of suspended solids and for the adjustment of pH to meet effluent standards. This system would have to be upgraded to handle the flows from all three blowdown streams. The cost for redesigning the system is estimated by TECO at about $1.2 million.

The Applicant states that treatment of the boiler and bottom-ash blowdowns in the FGD-bleed-stream-treatment system is not practicable for the following reasons:

1. Boiler blowdown will be very low in suspended solids (4 milligrams per liter) and will have a pH in the range of 8.5 to 9.0. These values are in compliance with effluent limitations.

2. Bottom-ash-transport slurry will be treated by ponding to remove suspended solids. The ponds have been designed to achieve a suspended-solids-removal efficiency that will allow the blowdown to meet effluent limitations, and the pH of the bottom ash will comply with effluent limitations without treatment.

2.6.3 SYSTEMS FOR THE CONTROL OF ATMOSPHERIC POLLUTION

The following is a discussion of the alternatives considered by TECO for the control of atmospheric pollution at Big Bend Unit 4. Systems for controlling the emissions of sulfur dioxide, particulate matter, nitrogen oxides, and carbon monoxide are treated in turn.

2.6.3.1 Alternatives for the Control of Sulfur Dioxide Emissions

Several systems were considered by TECO for the control of sulfur dioxide emissions: lime/limestone-slurry scrubbing with coal washing--the system that is preferred by TECO; the dual-alkali FGD system; the Wellman-Lord process; and a number of as yet unproved techniques, including chemical coal cleaning, coal treatment by solvent refining, fluidized-bed combustion, and the magnesium oxide process.

Lime/Limestone-Slurry Scrubbing with Coal Washing (Applicant's Proposed System)

Sulfur dioxide emissions from Big Bend Unit 4 will be minimized through a combination of coal washing and tail-gas cleaning using a forced-oxidation, double-loop FGD system. Based on as-mined coal-sulfur content, a 90 percent overall reduction in sulfur dioxide emissions is expected, and this will ensure compliance with the revised new-source performance standard (NSPS). It is further expected that, with raw-coal sulfur levels equal to or more than 3 pounds per million Btu (but no more than 6 pounds per million Btu), the overall sulfur dioxide-removal requirement of 90 percent will be achieved through a combination of 25 percent removal (in terms of pounds per million Btu) in washing, 5 percent retention in the ash from fired sulfur, and 86 percent removal in flue-gas cleaning.

The FGD system selected for Unit 4 is a two-stage, forced-oxidation, non-regenerable-limestone system capable of a removal efficiency of 85 to 90 percent. A generic description of the FGD process is given in Figure 2-13. Flue gases exiting the induced-draft fans are ducted to the inlet plenum of the FGD booster fans, from which the flow is distributed to three operating scrubber modules. The flue gases are scrubbed with a low-pH limestone slurry to cool the gas to its adiabatic saturation temperature of approximately 125°F and to remove sulfur dioxide. Dissolved limestone reacts with sulfite and sulfate ions to precipitate calcium sulfite and calcium sulfate solids.

The flue gases are next passed through to the absorber section (a combination spray tower/packed tower where the sulfur dioxide comes into contact with a high-pH recirculating slurry containing calcium salts). After passing through the absorber, the gases pass through a mist eliminator (a chevron type) upon which entrained droplets are deposited and thus removed from the gas stream.

The calcium sulfite solids generated are converted to gypsum. This waste-slurry stream is pumped to a bank of liquid cyclones and dewatered to 35 percent solids, and the thickened solids are further dewatered and washed to yield a gypsum cake of about 90 percent solids.*

After leaving the scrubber, flue gases are routed to a 490-foot stack.

The primary impact of this alternative on land systems will be the preemption of approximately 97 acres for the gypsum storage and disposal area. Potential water impacts include the degradation of surface-water quality by FGD-system blowdown and by leachate from the storage and disposal area and the effects of this leachate on ground-water levels and quality.

Using this control system, the sulfur dioxide emissions from Unit 4 will range from 2592 to 5184 pounds per hour as long as the sulfur content of the coal ranges from 3 to 6 pounds, as proposed by TECO. These emissions will be in conformity with the State of Florida ambient-air-quality standards (AAQS).

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*The gypsum crystals thus formed are of a size suitable for the manufacture of wallboard, and TECO is planning to market the gypsum for that purpose.

Dual Alkali with Sodium Carbonate

The dual-alkali FGD system uses two alkalies: sodium-base liquor in the scrubbing section and lime in the sodium-sulfite-regeneration section. There are several features of this system that make it economically unattractive for Big Bend Unit 4. The two alkalies used in this process are expensive and not readily available. While the absolute quantities of reagents are smaller for the double-alkali system than for the limestone system discussed above, the overall cost of reagents for the double-alkali system is very much greater. At the same time, the capital as well as the operating and maintenance costs of the two systems are not significantly different. In addition, the waste solids produced by this process have a high proportion of calcium sulfite and significant quantities of highly soluble sodium salts in their surface moisture. This waste would probably require stabilization to prevent the leaching of the salts at the disposal site and to prevent the calcium sulfite from exerting a chemical oxygen demand. Such developments would significantly increase the disposal costs.

If Unit 4 is equipped with this system, the sulfur dioxide emissions will conform to the State of Florida AAQS.

Sodium Carbonate (Wellman-Lord Process)

The Wellman-Lord process is a regenerable process that produces a marketable end product, either elemental sulfur or sulfuric acid. In the Tampa area, sulfuric acid would be the more desirable product, for there are several industries that use sulfuric acid. This system uses soda ash as its reagent supply and has removal efficiencies similar to the double-alkali FGD system. A demonstration plant at a utility in Gary, Indiana, is reported to have a design sulfur dioxide-removal efficiency of 90 percent. Since this system produces a marketable end product, waste disposal is minimized. Nevertheless, there are several features of this system that make it economically unattractive. The first is its energy-intensiveness, which exacts a severe economic penalty. The Wellman-Lord process requires higher capital and operating costs and has higher water requirements and energy penalties than other processes. The second unattractive feature is the high cost and limited availability of soda ash. Because of the very low reagent consumption of the system, however, this is not a very significant disadvantage. Third, a complete plant and a tank-farm facility are required for the production of the byproduct sulfuric acid. This would require additional capital and add to the operating and maintenance costs. Finally, the Applicant must enter into sulfuric acid sales, a market with which it is completely unfamiliar. Preliminary inquiries have revealed little interest in the purchase of such sulfuric acid. W. R. Grace Company, Allied Chemical Company, Swift Agricultural Chemicals Corporation, Ashland Chemical Company, and Canadian Industries Limited were contacted. All indicated that they were not interested in the outright purchase of the sulfuric acid; they were interested, however, in becoming marketing agents.

If Unit 4 is equipped with this system, the sulfur dioxide emissions will conform to the State of Florida AAQS.

Other Alternatives

Several other alternatives for controlling atmospheric emissions were eliminated from detailed consideration for the reasons described below.

Chemical Coal Cleaning. Chemical coal cleaning is a fuel-pretreatment technique that employs pulverization followed by the addition of either an oxidation agent or a leachant. The sulfur compounds thus generated are removed by leaching or magnetic separation. Chemical cleaning has not as yet been applied full scale in the pretreatment of coal. Since the chemical processes are neither economically competitive nor sufficiently demonstrated, they are not considered feasible for Big Bend Unit 4.

Solvent-Refined Coal. In solvent-refining processes, pulverized raw coal is dissolved in a coal-derived solvent in a hydrogen atmosphere at elevated temperature and pressure. Several demonstration plants have been operated in the United States, but the economics and feasibility of these plants are still being evaluated. Consequently, this technique is not considered currently available for use by Big Bend Unit 4.

Fluidized-Bed Combustion. Fluidized-bed combustion (FBC) involves the burning of coal in a bed that contains both inert ash and an active sorbent that is used for sulfur dioxide-emission control. The bed is suspended by combustion air forced through the plate supporting the bed. The sorbent fed to the process, generally either dolomite or limestone, is calcined in the bed. Two types of FBC processes are currently being developed: atmospheric FBC steam generation and the pressurized FBC combined-cycle process. Bench-scale models, pilot plants, and prototype units have been developed and evaluated by several manufacturers. There are, however, major problems yet to be resolved with regard to hot-gas cleanup, materials of construction, and scale-up design data. FBC is currently neither economical nor practical for application to full-scale electricity generation and therefore is not considered a feasible alternative for Big Bend Unit 4.

Magnesium Oxide Process. The magnesium oxide process is a postcombustion system that involves the use of magnesium oxide to absorb sulfur dioxide in a wet scrubber and the subsequent regeneration of the magnesium oxide for the production of commercial sulfuric acid. This process is presently undergoing continued testing, modification, and demonstration at utility plants. Considerable gaseous emission and dust-emission problems have been encountered. The demonstration plants have shown 90 percent sulfur dioxide recovery. However, in view of its low availability and high capital and operating costs, the system is not considered a feasible alternative for Big Bend Unit 4.

2.6.3.2 Alternatives for the Control of Particulate Emissions

The alternatives considered for the control of particulate-matter emissions from Big Bend Unit 4 were electrostatic precipitation, which is preferred by TECO, and fabric-filter particulate-collection systems.

Electrostatic Precipitation (Applicant's Proposed System)

Emissions of particulate matter from the boiler of Big Bend Unit 4 will be controlled by an electrostatic precipitator (ESP). The completed specification for the Unit 4 ESP requires the manufacturer to guarantee an outlet particulate-matter emission of 0.03 pound per million Btu and 20 percent opacity, which matches the applicable NSPS for electric utility steam-generating units. Accordingly, the collection efficiency will be a minimum of 99.7 percent. The design and performance requirements for the ESP are based on the use of a specific coal that TECO expects to use in Unit 4.

The ESP will be capable of incorporating future technological advances to meet the NSPS requirements pertaining to the firing of low-sulfur coal as boiler fuel. A rigid-frame design was selected to provide added reliability over the weighted-wire design frequently used for the high-voltage electrodes. A redundant electrical field will also be added to increase its reliability.

Like the fly ash from existing Big Bend units, fly ash collected in Unit 4 will be marketed by TECO. Provision will be made for the onsite disposal of fly ash should the market for the ash cease to exist.

The maximum concentration of total suspended solids that will be emitted by Unit 4 is 3.7 micrograms per cubic meter. These emissions are below the level of significant impact and conform to the State of Florida AAQS.

The primary impact of this alternative on land systems will be the preemption of approximately 121 acres for the settling ponds and disposal cells for bottom ash, unmarketable fly ash, pyrites removed from the coal before combustion, and economizer ash. Other potential impacts include the effects of runoff and seepage from the disposal sites and possible adverse effects on the waterfowl that may be attracted to the active disposal ponds. Potential water impacts include the degradation of surface-water quality by bottom-ash blowdown and the effects of leachate from the bottom- and fly-ash ponds and disposal cells on ground-water levels and quality.

Fabric-Filter Systems

The only alternative to electrostatic precipitation investigated was fabric-filter particulate-collection equipment. This type of equipment is regarded as the only technically feasible alternative capable of adequately limiting emissions from Big Bend Unit 4. It has been commercially demonstrated on both utility and industrial boilers and has achieved emission reductions of substantially more than 99 percent.

To meet the NSPS for particulate emissions, the Unit 4 steam generator will use an ESP rather than a fabric-filter installation. The selection is based primarily on the demonstrated availability and reliability of the ESP at similar facilities firing high-sulfur coals. Moreover, ESPs and baghouses are considered to be capable of comparable particulate-collection efficiencies for boilers firing coals under consideration for Unit 4. Generally, the fabric filter is capable of providing slightly higher removal efficiencies. However, the cost effectiveness of the ESP versus the fabric filter is dependent on the sulfur content of the fuel. For a low-sulfur application, the fabric filter would usually be more cost-effective in achieving high removal efficiencies; the ESP required to approximate the same efficiency would be very large owing to the increased electrical resistivity of the ash. This does not hold true for a medium- to high-sulfur coal like that to be used at Big Bend Unit 4. Here, the reduced electrical resistivity of the ash permits the use of a much smaller ESP that approximates fabric-filter efficiency. Thus, the ESP becomes much more cost-effective than the fabric filter for this application. In addition, the fabric-filter equipment would operate with a higher energy loss due to gas-pressure drop, and its operating and maintenance costs would be significantly higher for this application.

2.6.3.3 Alternatives for the Control of Nitrogen Oxide Emissions

Generally, required reductions in nitrogen oxide emissions are possible through alternative combustion techniques, which include water or steam injection; flue-gas recirculation; and over-fire air, also known as two-stage combustion. The proposed combustion-type control technology for nitrogen oxide emissions from the Unit 4 boiler is considered the only available system capable of meeting the NSPS and thus it is the Applicant's proposed system.

The emission of nitrogen oxide from the combustion system will be minimized by the design of the burners and boiler to be provided by the boiler manufacturer, Combustion Engineering, Inc. (CE). The balance-draft boiler with a tangentially fired furnace to be used at Unit 4 has a demonstrated capability of limiting nitrogen oxide formation from the firing of bituminous coal to 0.6 pound per million Btu as nitrogen dioxide. This meets the applicable NSPS. The EPA has certified several CE boilers now in operation as capable of meeting this standard, but these boilers were neither designed nor guaranteed to limit nitrogen oxide emissions to these levels.

The nitrogen oxide emissions from Unit 4 will be 2598 pounds per hour. The maximum annual nitrogen dioxide concentration will be 0.5 microgram per cubic meter. This impact is in compliance with the State of Florida AAQS.

2.6.3.4 Control of Carbon Monoxide Emissions

Carbon monoxide emissions from the Unit 4 boiler will be minimized by operation at excess-air levels sufficient to achieve essentially complete combustion to carbon dioxide and by the appropriate design of the combustion-air control system. This system is judged the best available control technology for carbon monoxide because no alternative means of controlling this pollutant are currently available or under development.

The estimated emissions of carbon monoxide from Unit 4 are 2457 pounds per hour. The maximum 3-hour concentration is predicted to be less than 8 micrograms per cubic meter, which is far below the level of significant impact.

The emissions of carbon monoxide are not controlled by Federal or State regulations.

2.6.4 SOLID-WASTE DISPOSAL

2.6.4.1 Description of Solid Wastes

The operation of the proposed Big Bend Unit 4 will produce several kinds of solid waste: gypsum from the FGD system, pyrites removed from coal before combustion, and ash from coal combustion (Table 2-9). In addition, Unit 4 will generate economizer ash and waste solids from water treatment.

In the FGD system, calcium/sulfur chemical solids are precipitated during the reaction between the limestone-slurry feed and the sulfur dioxide dissolved in the scrubber outlet liquid. These solids and any unused solid portion of the limestone-slurry feed are dewatered to a cake.

Ash, a noncombustible component of coal, is produced when coal is burned in the boiler. Two kinds of ash result when coal is burned: "bottom" ash and "fly" ash. Bottom ash, which has a larger particle size than fly ash, falls to the bottom of the boiler furnace during combustion. Fly ash, which is fine particulate matter, leaves the boiler with the flue gases and is collected by the electrostatic precipitators.

Pyrites are metallic sulfides rejected from coal pulverizer mills. Water-treatment solids are precipitated by chemical reaction or clarification as wastewater is processed for reuse.

2.6.4.2 Solid-Waste Disposition (Applicant's Proposed Systems)

Bottom ash will be collected in a water-filled hopper and sluiced to a bottom-ash-disposal pond located in the area currently occupied by an unused U-shaped cooling pond. The conceptual layout of the area is shown in Figure 2-14. The bottom ash will be sluiced to either of two primary settling ponds formed by earthen dikes. Overflow from the primary settling ponds will flow by gravity to a secondary settling pond. Clarified water will then be pumped back to the plant, completing the recirculation system. Most of the bottom ash will settle in the primary settling ponds. Once these ponds are filled, the ash will be hydraulically dredged to a final disposal cell developed as the need for disposal volume arises. The cells, formed by earthen dikes, are expected to reach a maximum height of 35 feet. The estimated quantity of bottom ash produced is 25,680 tons per year. Unmarketable fly ash, economizer ash, and pyrites removed from the coal before combustion will be sluiced to a fly-ash pond as shown in Figure 2-14.

Fly ash from Unit 4 will be removed from the flue gas by electrostatic precipitation, collected in hoppers, and pneumatically transported to silos for storage and subsequent sale as a raw material in the production of portland cement. To guard against a decrease in fly-ash demand, which could jeopardize the dependability of the unit, provisions for the disposal of fly ash from Unit 4 have been made. At times when it may be impossible to market Unit 4 fly ash, the ash-disposal pond will be used. The conceptual layout of the fly-ash-disposal area is shown in Figure 2-14. The solids will be sluiced from the plant to either one of two lined primary settling ponds. Overflow from these ponds will flow by gravity to a lined secondary settling pond. Clarified water will be pumped back to the plant, completing the recirculation system. When the ponds reach the point at which they must be cleaned, a final earthen-diked disposal cell will be constructed and lined. The ash will be hydraulically dredged to the disposal cell.

The waste produced by the FGD system will consist mainly of gypsum, which will be handled and stored in an area south of the Unit 4 ash pond. The estimated annual gypsum production is 210,000 tons.

The gypsum is considered to have greater market potential than any other possible byproduct of an FGD system. It has been successfully used in the production of wallboard, in cement manufacturing as a set retarder, and in agriculture as a soil additive. The existence of major wallboard manufacturing in Florida suggests that the FGD gypsum is marketable. However, the uncertain marketability of the gypsum, combined with the instability of the national economy, make it difficult to formulate plans for gypsum management.

To deal with this uncertainty, TECO has developed a multiphase plan for gypsum storage and disposal. The purpose of this plan is (1) to provide gypsum storage during periods of low gypsum demand and (2) to provide time for the establishment of a long-range plan for the disposal of gypsum should a permanent market fail to materialize.

The proposed gypsum storage and disposal site is south and southeast of the Big Bend power plant. Figure 2-14 shows the four storage and disposal areas to be used when and as needed. The total area covers 97 acres of previously cultivated land and pasture that are currently zoned for industrial use. The area was chosen to ensure the preservation of Newman Branch and related wetlands.

Plans for the storage and disposal of gypsum require the successive use of the four separate land areas indicated. A new area will be developed only when an area in service has been filled almost to capacity. The plans provide for either permanent disposal or short-term storage of gypsum, as required. The use of the comparatively small disposal areas shown in Figure 2-14 will allow good control of rainfall runoff and of housekeeping operations if substantial quantities of gypsum should accumulate.

If substantial gypsum storage proves necessary, a landfill will be created using the heaped-fill configuration shown in Figure 2-15. This technique is deemed to be the most adequate in view of the geologic and topographic characteristics of the site.

Experience with coarse-grained materials in this type of landfill has shown that problems with ground-water pollution, slope stability, and site preparation are minimal in comparison with other disposal methods. Fugitive-dust problems are not expected because the gypsum, when left undisturbed, forms a protective crust that minimizes wind erosion and dust formation. In order to contain the gypsum, berms will be constructed around the entire area. These berms will be designed to withstand a 100-year flood and storm surge. Stormwater falling within the bermed area will be directed to temporary stormwater storage in that area. It will then be allowed to percolate into the ground or evaporate.

The primary impacts of the proposed solid-waste-disposal methods on land systems will be the preemption of approximately 97 acres for the gypsum storage and disposal area and approximately 121 acres for the bottom- and fly-ash settling ponds and disposal cells. Other potential impacts include the effects of runoff and seepage from the disposal sites and possible adverse effects on the waterfowl that may be attracted to the active disposal ponds. Potential water impacts include the effects of leachate from these areas on ground-water levels and quality.

2.6.4.3 Alternative Waste-Disposal Schemes

Disposal schemes other than that selected for Big Bend Unit 4 include (1) offsite disposal and (2) commercial application without throwaway disposal. The lining of the gypsum storage and disposal area was also evaluated.

For purposes of offsite disposal, the ash and scrubber sludge would have to be transported great distances to either a coal mine, a limestone quarry, a phosphate mine, an impoundment, or a landfill. The cost of such transport is a major deterrent to offsite disposal. More compelling than the transport problem, however, are the excellent prospects for the sale of large amounts of the wastes to users with time-varying demands. These prospects call for retaining the wastes at the site until they are needed by the purchaser(s). The two waste products thus have significant commercial potential, and for that reason, throwaway disposal may be deemed inappropriate.

Each of these alternative schemes for solid-waste disposal has major disadvantages, and neither constitutes a feasible option to the approach selected by TECO for Big Bend Unit 4. The alternative of lining gypsum storage and disposal areas was evaluated in a 20-month study conducted by the Electric Power Research Institute at a power plant in northern Florida. The results of that study showed that the disposal in an unlined area of gypsum produced by an FGD system similar to that proposed for Big Bend Unit 4 had no adverse impact on the quality of water in the surficial or Floridan aquifers in the vicinity of the disposal site. In view of these findings, TECO sees no material benefit in the investment of an estimated $1.1 million to install a flexible, synthetic liner in the gypsum storage and disposal area.

2.6.5 TRANSMISSION RIGHT-OF-WAY (APPLICANT'S PROPOSED ALTERNATIVE)

One 230-kilovolt circuit with a length of 2970 feet (9/16 mile) will connect Big Bend Unit 4 to the existing Big Bend substation. Electric power generated by the unit will enter the existing TECO transmission system at that point. The new transmission circuit will use existing towers and the existing transmission route between the plant and the substation.

No additional land will be required for the Unit 4 transmission route, nor will it be necessary to clear additional vegetation and trees or to make other changes in the topography. There will be no impact on sensitive areas or landmarks.

Table 2-5. Comparison of the major environmental impacts of the principal alternatives for waste-heat rejection

Alternative	Thermal impacts	Entrainment impacts	Impingement impacts	Salt drift impacts	Fogging	Land requirements
1. Once-through cooling for Units 1-4, conventional screens, no dilution	Area of the warmest portions of the plume larger than that of any other alternative	Large numbers of organisms entrained (approximately 33% more than present entrainment with Units 1-3)	Impingement rates about 33% higher than present levels with Units 1-3	None	Occasional fogging of water areas into which discharge plume flows; some increase in area over existing situation with Units 1-3	Considered as base condition for this analytical table
2. Same as Alternative 1, but with dilution	Overall plume larger than that of any other alternative, but area of warmest temperatures smaller than that of Alternative 1	More organisms entrained than with any other alternative because of additional organisms introduced into thermal plume by dilution	Approximately the same as Alternative 1	None	About the same as Alternative 1	Commitment of small additional area adjacent to existing dilution system for third pump
3. Once-through cooling for Units 1-4, fine-mesh screens on Units 3 and 4, no dilution	Same as Alternative 1	Numbers of organisms entrained about the same as for existing Units 1-3	Impingement rates somewhat below present levels	None	Same as Alternative 1	Commitment of some small additional area in intake canal
4. Same as Alternative 3, but with dilution	Same as Alternative 2	Entrainment rate somewhat lower than with Alternative 2	Approximately the same as Alternative 3	None	Same as Alternative 2	Commitments as for Alternative 2 and 3 combined
5. Once-through cooling for Units 1-4, fine-mesh screens on all units, no dilution	Same as Alternative 1	Lowest entrainment rate of all once-through alternatives; rate below that of existing system on Units 1-3	Lowest impingement rate of any of the once-through alternatives	None	Same as Alternative 1	Commitments of small area intake canal beyond that needed for Alternative 3
6. Same as Alternative 5, but with dilution	Same as Alternative 2	Numbers entrained greater than for Alternative 5 because of additional organisms introduced into thermal plume by dilution flow	Approximately the same as Alternative 5	None	Same as Alternative 2	Commitments as for Alternatives 2 and 5 combined
7. Saltwater cooling towers for Unit 4	Very small increase in size of thermal plume over present situation with Units 1-3	Very small increase in numbers entrained over present situation with Units 1-3	Very small increase in numbers impinged over present situation with Units 1-3	Largest quantities of salt released into air than with any cooling-tower alternative considered	Some fogging in area of the tower; no increase in sea fogging over present situation with Units 1-3	Large commitment of additional land areas to the south of discharge canal near mangrove area
8. Brackish-water cooling towers for Unit 4	Same as Alternative 7	Same as Alternative 7	No impact	Somewhat smaller quantities of salt released than in Alternative 7	Same as Alternative 7	Same as Alternative 7
9. Freshwater-cooling towers for Unit 4	Same as Alternative 7	Same as Alternative 7	No impact	Lowest quantities of salt released of any cooling-tower alternative considered	Same as Alternative 7	Same as Alternative 7

Table 2-6. Flows and velocities of circulating water in the intake and discharge channels of Big Bend Units 1-4[a]

Parameter	Unit 1	Unit 2	Unit 3	Unit 4
Intake channel				
Flow rate, cfs	537	537	537	537
Cumulative flow, cfs	2148	1611	1074	537
Velocity, fps	0.56	0.42	0.28	0.14
Discharge channel				
Unit flow, cfs	537	537	537	537
Cumulative flow, cfs	2148	1611	1074	537
Velocity, fps	0.25	0.18	0.12	0.06

Abbreviations:
cfs = cubic feet per second.
fps = feet per second.

[a] From TECO (1980, 1981).

Table 2-7. Costs of using once-through cooling with fine-mesh screens and a mechanical-draft cooling tower at Big Bend Station[a] (Thousands of dollars)

Costs	Once-through cooling with fine-mesh screens		
	Units 3 and 4	Units 1 and 2	Cooling tower
Capital	$ 8,690	$6460	$31,373
Revenue requirements			
Operating cost penalties	520	520	19,256
Operation and maintenance	1,005	1005	1,173
Total evaluated cost	$10,215	$7985	$51,802

[a] Information obtained from TECO, January 1981.

Table 2-8. Wastewater recycle flow designs associated with Big Bend Unit 4[a,b]

Operation	Average flow (gpd)	Maximum flow (gpd)	Duration (hr)	Frequency
FGD system wash	66,600	133,300	--	--
Air preheater wash	9,400	9,400	8	1 every 3 months
Precipitator wash	5,300	5,300	80	3 per year
Economizer wash	300	300	4	3 per year
Sparging system	4,600	4,600	24	3 per year
Boiler external wash	1,600	1,600	24	2 per year

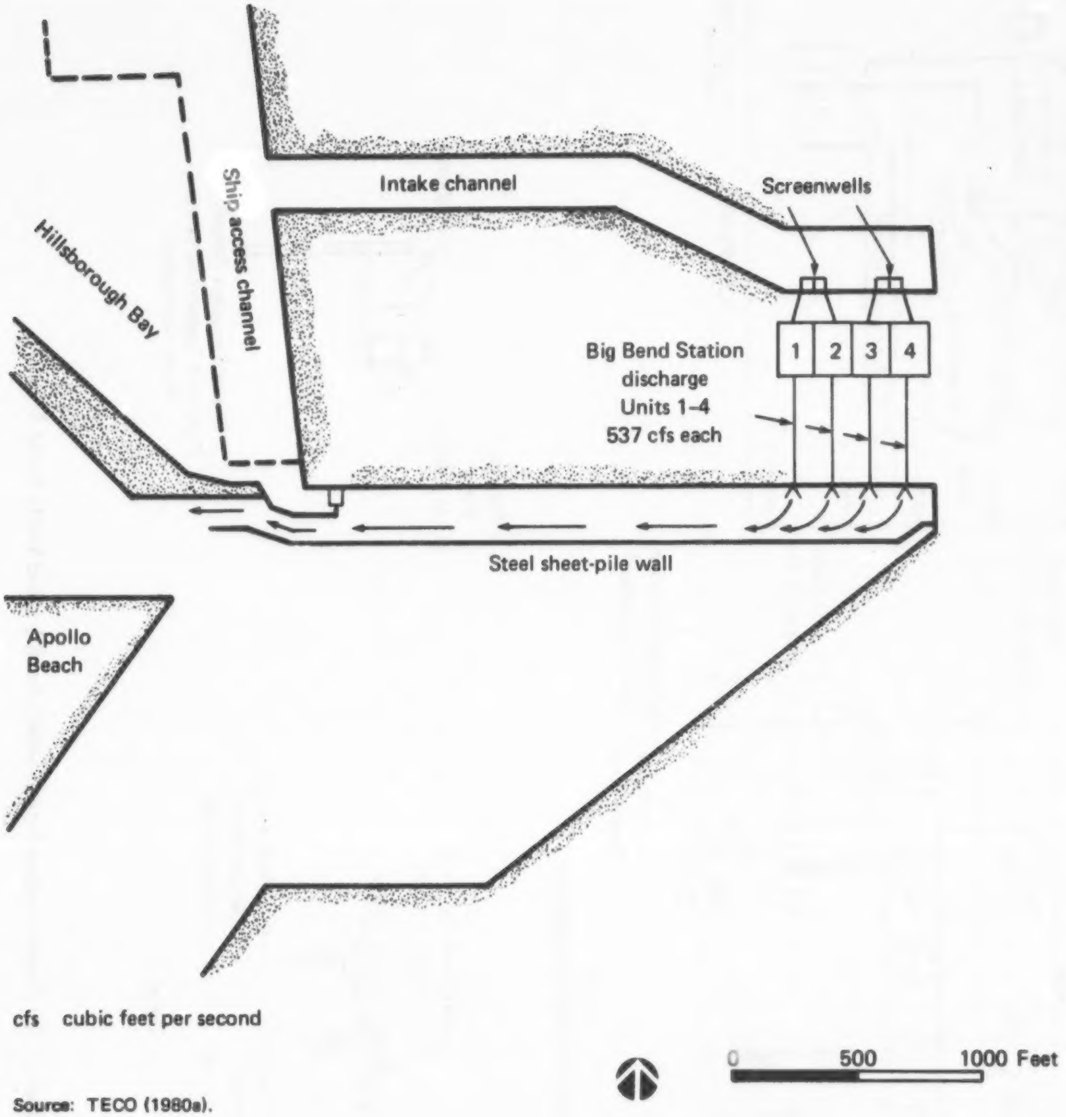
Abbreviations:
gpd = gallons per day.
FGD = flue-gas-desulfurization.

[a] Adapted from TECO (1981).
[b] All flows intermittent in nature.

Table 2-9. Solid wastes produced by Big Bend Unit 4[a]

Waste material	Quantity (tons/yr)[b]
Bottom ash[c]	25,680
Pyrites[d]	19,000
Fly ash[e]	102,700
Gypsum	210,000

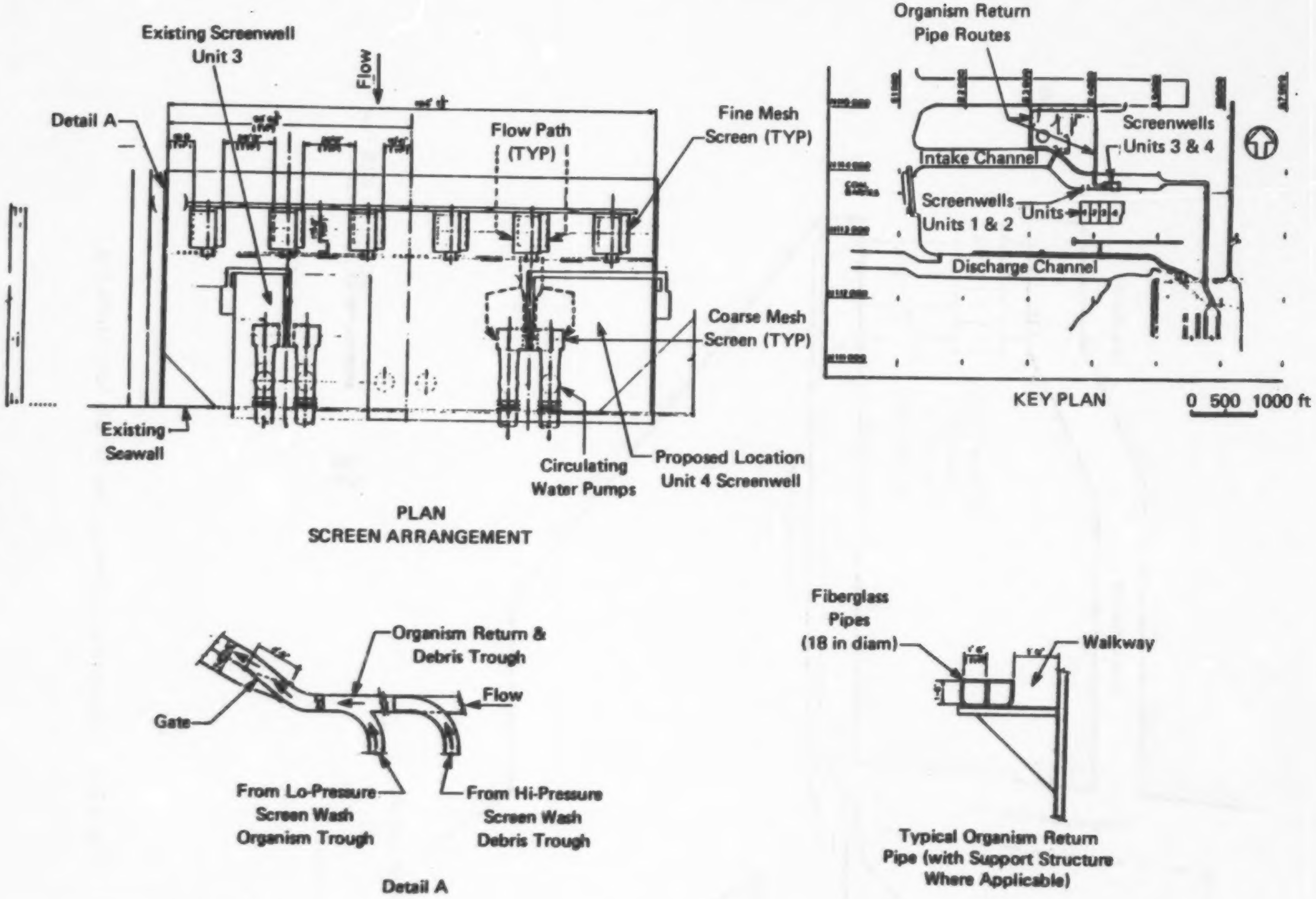
[a] From TECO (1979).
[b] Based on the use of coal with an ash content of 13.5 percent and on a 28-year average capacity factor of 52.57 percent.
[c] Bottom ash assumed to be 20 percent of ash content.
[d] Pyrites assumed to be 2 percent of coal.
[e] Fly ash assumed to be 80 percent of ash content.


Intake channel
Screenwells
Ship access channel
Hillsborough Bay
Big Bend Station discharge Units 1-4 537 cfs each
1
2
3
4
Steel sheet-pile wall
Apollo Beach
0
500
1000 Feet

cfs cubic feet per second

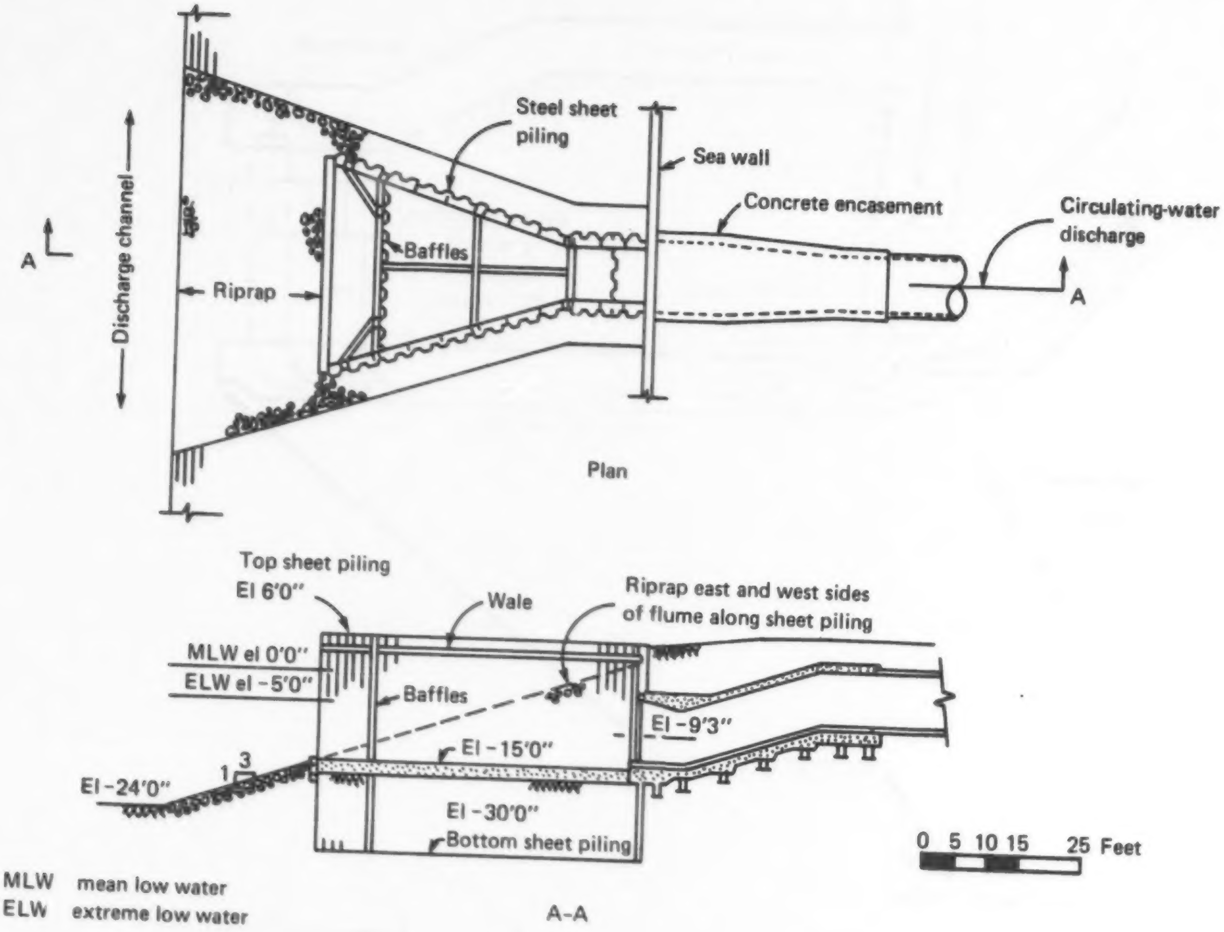
Source: TECO (1980a).

Figure 2-6. Once-through cooling system for Big Bend Units 1-4.


Existing Screenwell
Unit 3
Flow
Detail A
Flow Path
(TYP)
Fine Mesh
Screen (TYP)
Coarse Mesh
Screen (TYP)
Existing
Seawall
Circulating
Water Pumps
Proposed Location
Unit 4 Screenwell
PLAN
SCREEN ARRANGEMENT
Organism Return
Pipe Routes
Screenwells
Units 3 & 4
Intake Channel
Screenwells
Units 1 & 2
Units
Discharge Channel
KEY PLAN
0 500 1000 ft
Organism Return &
Debris Trough
Flow
Gate
From Lo-Pressure
Screen Wash
Organism Trough
From Hi-Pressure
Screen Wash
Debris Trough
Detail A
Fiberglass
Pipes
(18 in diam)
Walkway
Typical Organism Return
Pipe (with Support Structure
Where Applicable)

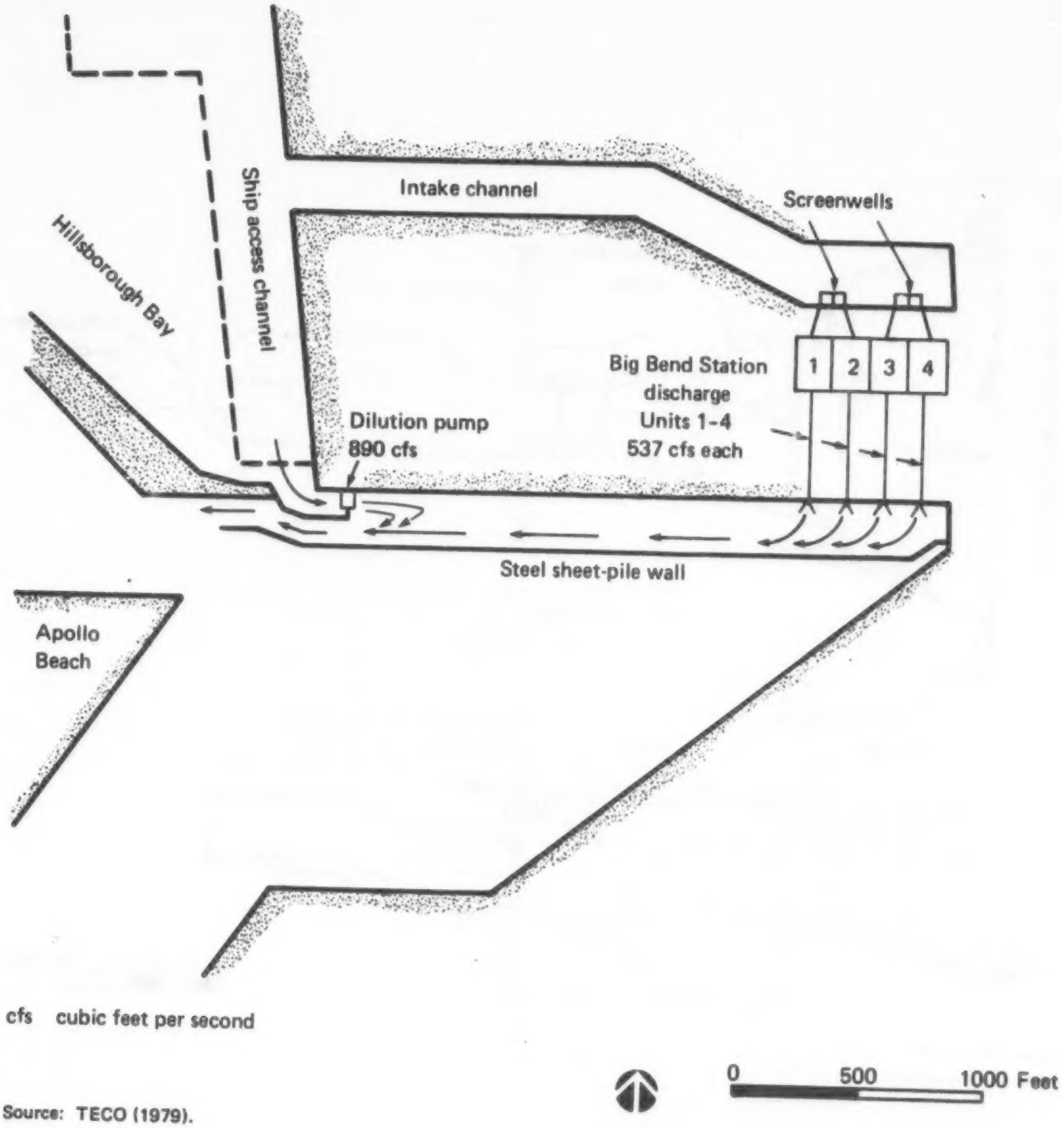
Source: TECO (1980b).

Figure 2-7. Dual-flow fine-mesh screens for Big Bend Units 3 and 4.


Steel sheet piling
Sea wall
Concrete encasement
Circulating-water discharge
A
A
Discharge channel
Baffles
Riprap
Plan
Top sheet piling
El 6'0"
Wale
Riprap east and west sides of flume along sheet piling
MLW el 0'0"
ELW el -5'0"
Baffles
El -9'3"
El -15'0"
1
3
El -24'0"
El -30'0"
Bottom sheet piling
0 5 10 15 25 Feet
MLW mean low water
ELW extreme low water
A-A

Source: TECO (1980b).

Figure 2-8. Discharge structure at Big Bend Station.


Hillsborough Bay
Ship access channel
Intake channel
Screenwells
1
2
3
4
Big Bend Station discharge Units 1-4 537 cfs each
Dilution pump 890 cfs
Steel sheet-pile wall
Apollo Beach
0
500
1000 Feet

cfs cubic feet per second

Source: TECO (1979).

Figure 2-9. Once-through cooling system with dilution for Big Bend Units 1-4.

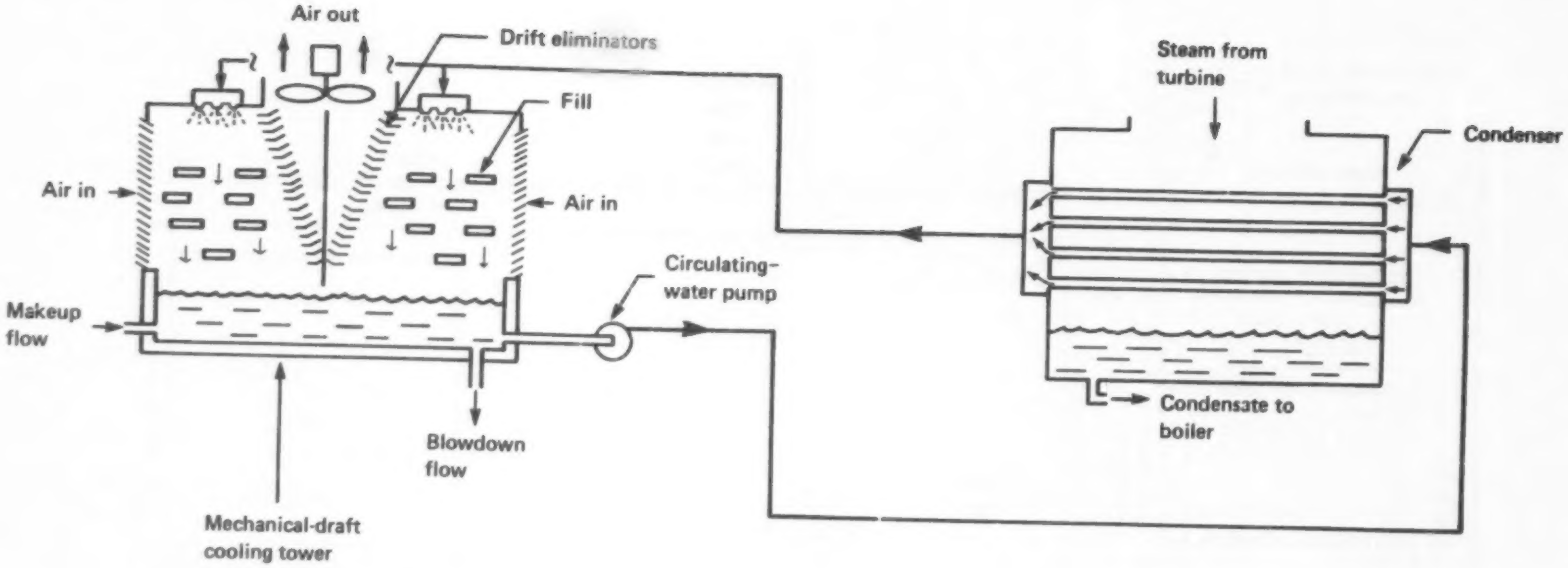
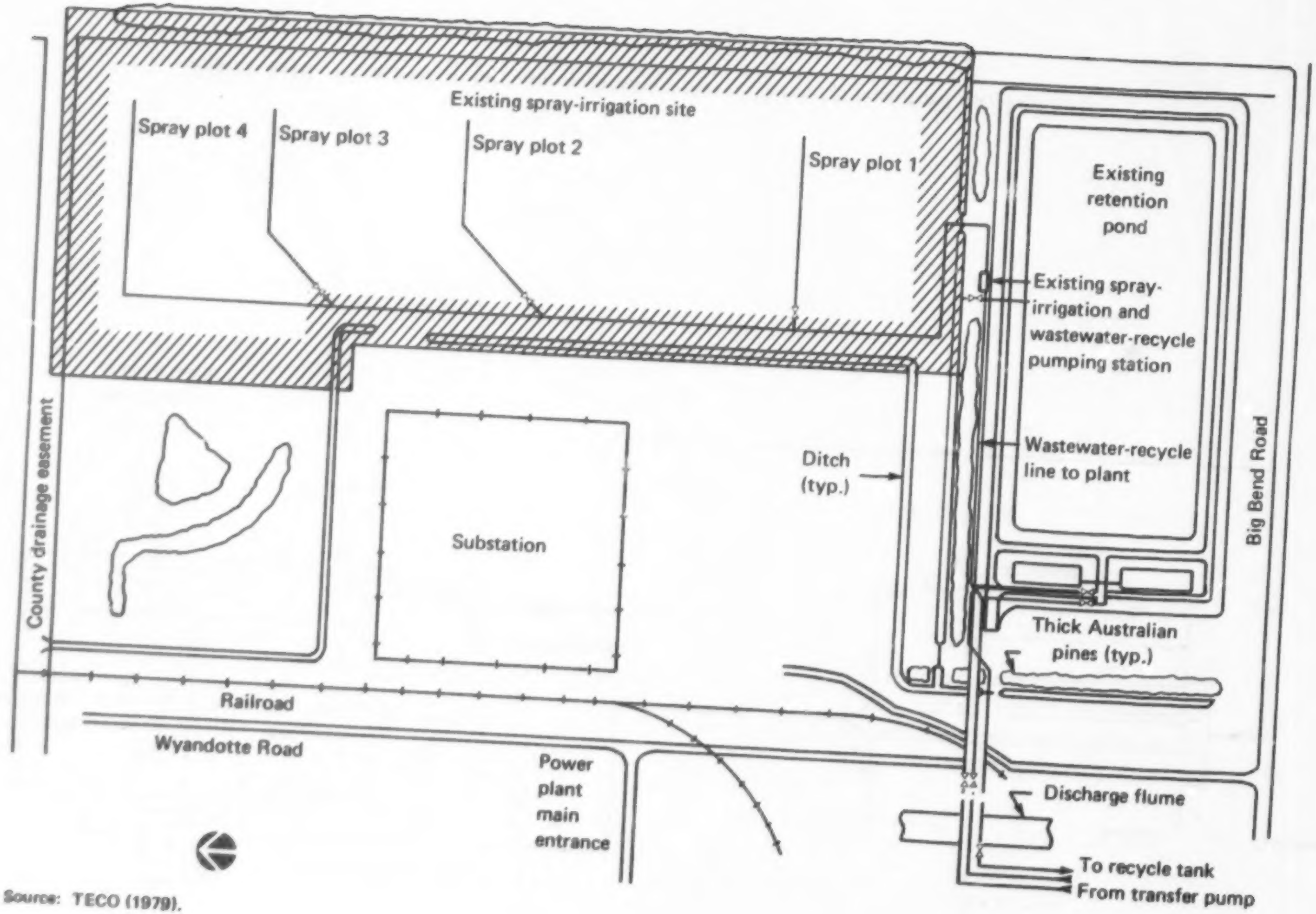
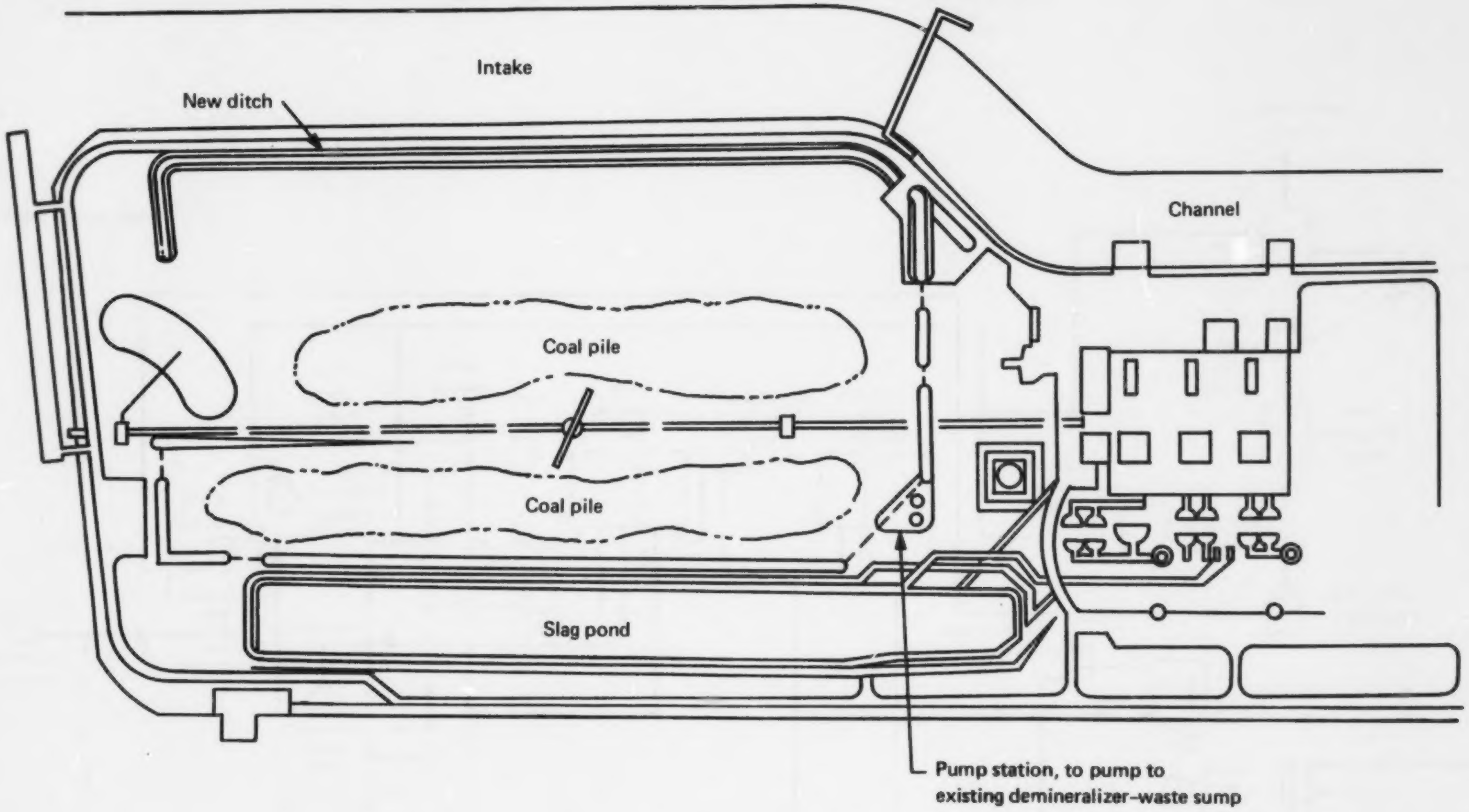

Air out
Drift eliminators
Fill
Air in
Air in
Makeup flow
Circulating-water pump
Blowdown flow
Mechanical-draft cooling tower
Steam from turbine
Condenser
Condensate to boiler

Figure 2-10. Flow path of condenser cooling water with mechanical-draft cooling tower.


Existing spray-irrigation site
Spray plot 4
Spray plot 3
Spray plot 2
Spray plot 1
Existing retention pond
Existing spray-irrigation and wastewater-recycle pumping station
Wastewater-recycle line to plant
Ditch (typ.)
Big Bend Road
Substation
County drainage easement
Thick Australian pines (typ.)
Railroad
Wyandotte Road
Power plant main entrance
Discharge flume
To recycle tank
From transfer pump

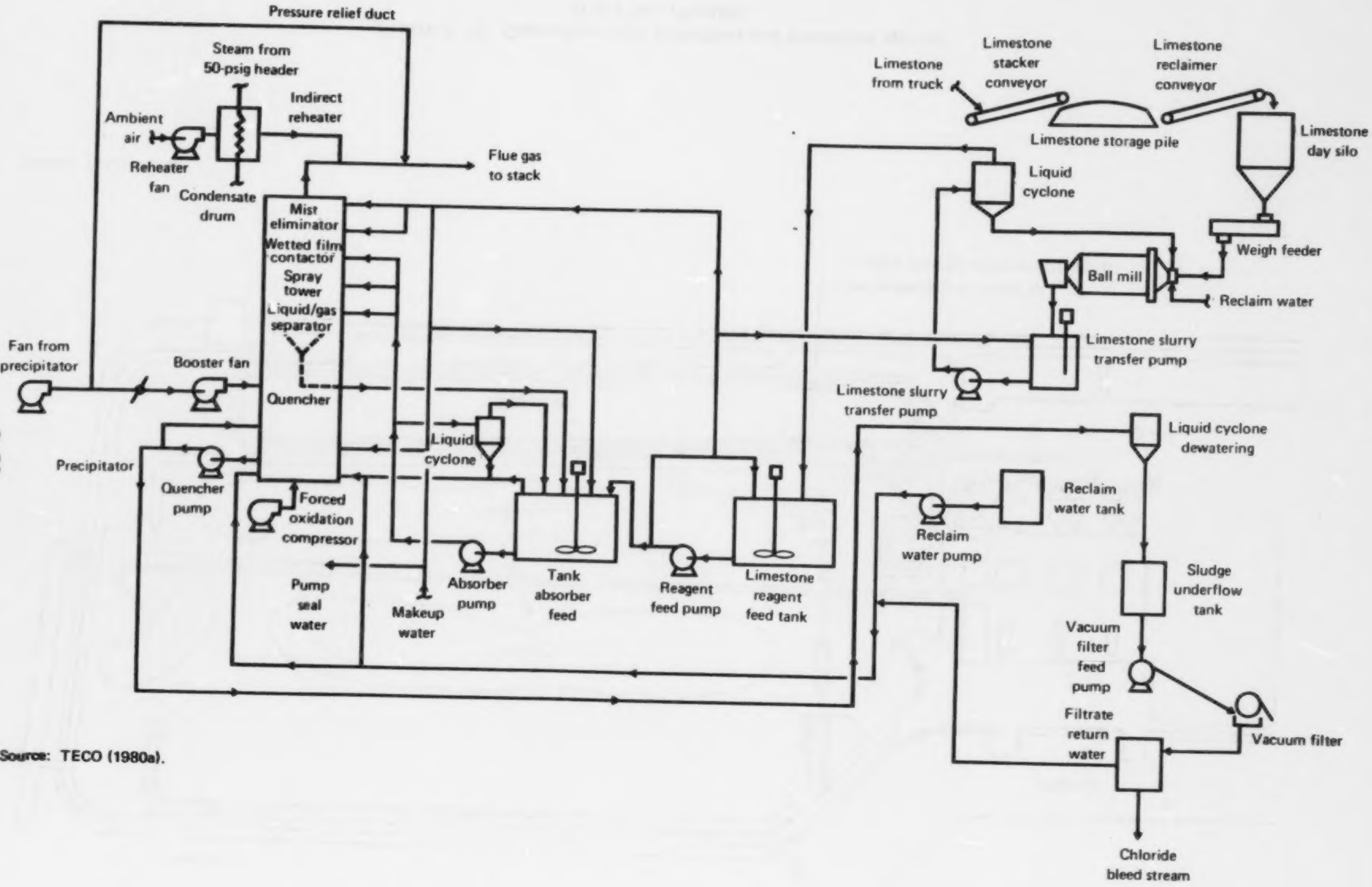
Source: TECO (1979).

Figure 2-11. Wastewater-treatment pond and irrigation system at Big Bend Station.


Intake
New ditch
Channel
Coal pile
Coal pile
Slag pond
Pump station, to pump to existing demineralizer–waste sump

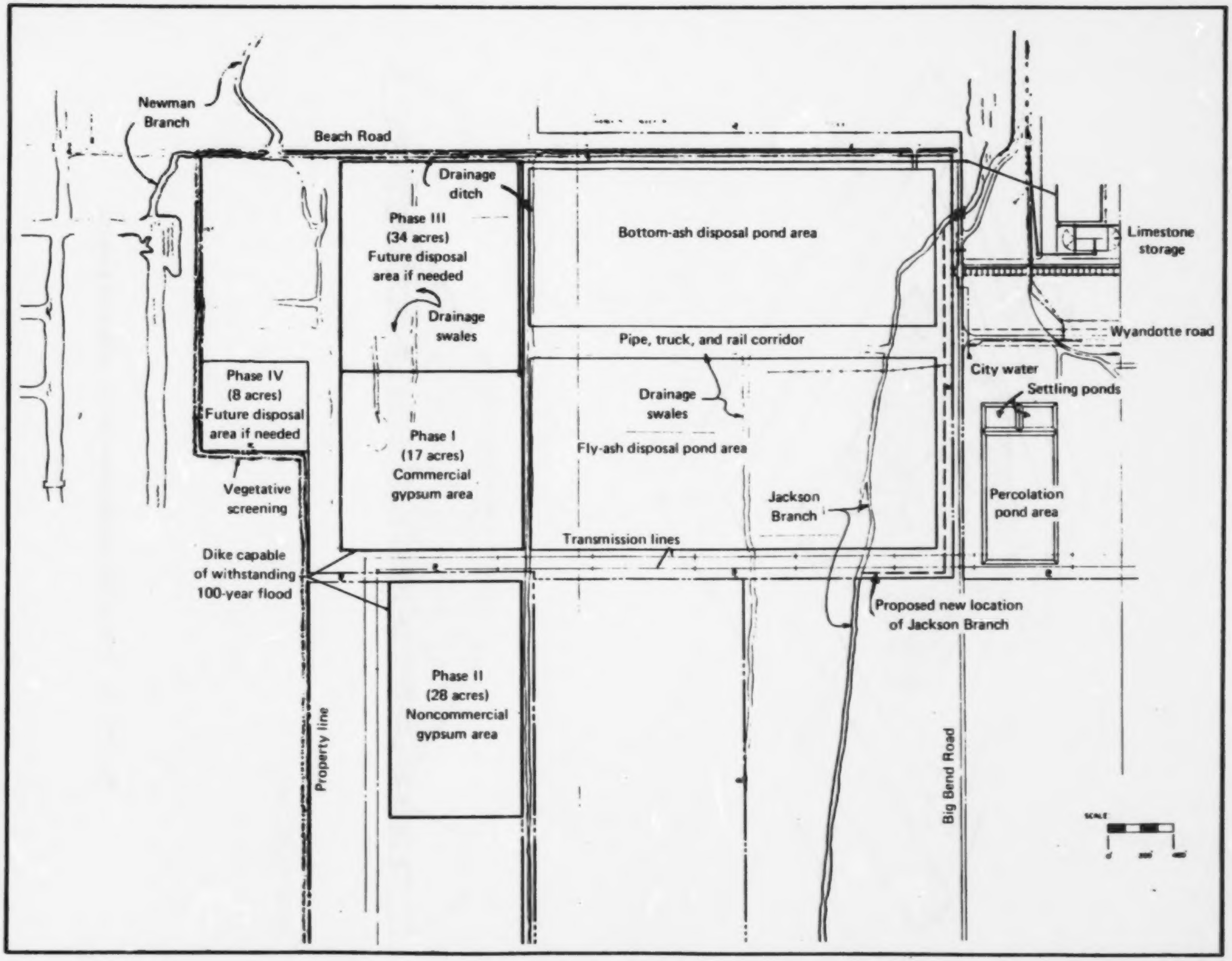
Source: TECO (1980a).

Figure 2-12. Coal-pile-runoff collection and treatment system at Big Bend Station.


Pressure relief duct
Steam from 50-psig header
Indirect reheater
Ambient air
Reheater fan
Condensate drum
Flue gas to stack
Mist eliminator
Wetted film contactor
Spray tower
Liquid/gas separator
Quencher
Fan from precipitator
Booster fan
Precipitator
Quencher pump
Forced oxidation compressor
Pump seal water
Makeup water
Liquid cyclone
Absorber pump
Tank absorber feed
Reagent feed pump
Limestone reagent feed tank
Limestone from truck
Limestone stacker conveyor
Limestone storage pile
Limestone reclaimer conveyor
Limestone day silo
Liquid cyclone
Weigh feeder
Ball mill
Reclaim water
Limestone slurry transfer pump
Limestone slurry transfer pump
Liquid cyclone dewatering
Reclaim water tank
Reclaim water pump
Sludge underflow tank
Vacuum filter feed pump
Vacuum filter
Filtrate return water
Chloride bleed stream

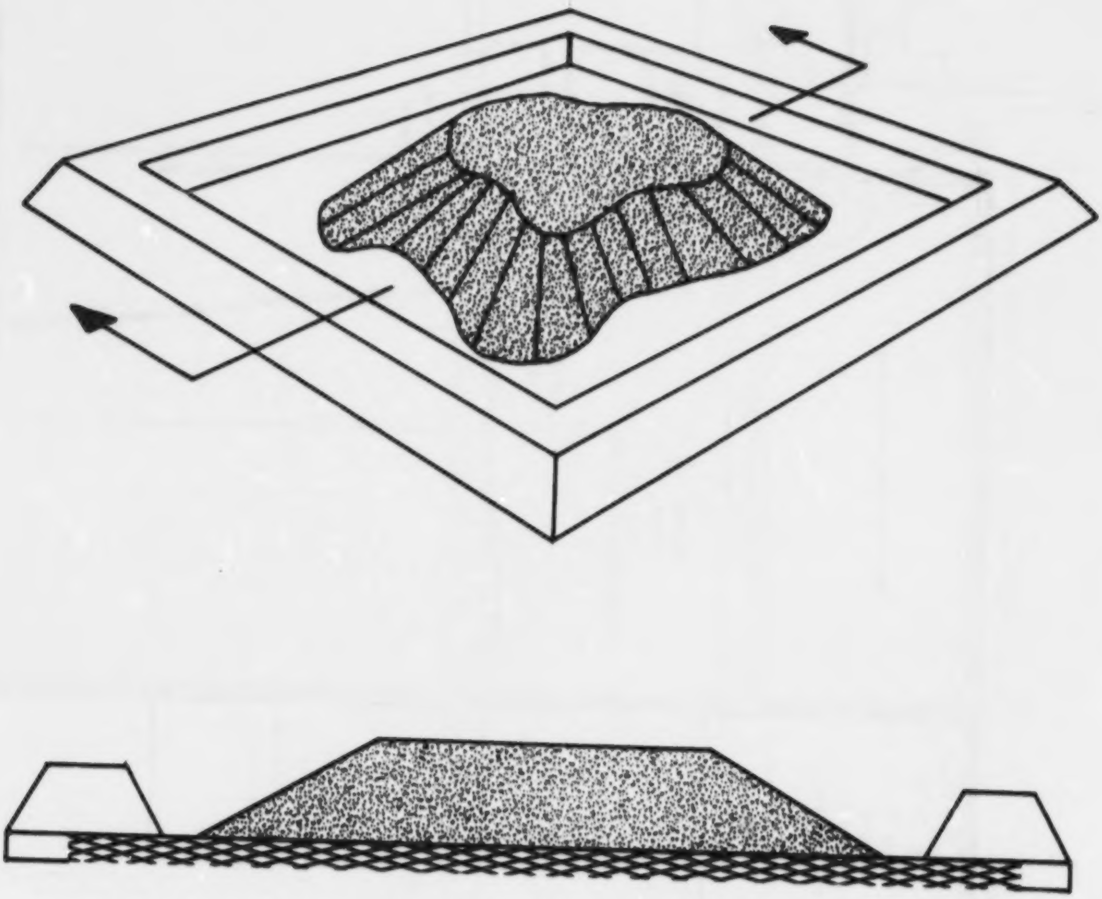
Source: TECO (1980a).

Figure 2-13. Limestone FGD system for Big Bend Unit 4.


Newman Branch
Beach Road
Drainage ditch
Phase III (34 acres) Future disposal area if needed
Drainage swales
Bottom-ash disposal pond area
Limestone storage
Pipe, truck, and rail corridor
Wyandotte road
City water
Settling ponds
Phase IV (8 acres) Future disposal area if needed
Drainage swales
Fly-ash disposal pond area
Phase I (17 acres) Commercial gypsum area
Vegetative screening
Jackson Branch
Percolation pond area
Transmission lines
Dike capable of withstanding 100-year flood
Proposed new location of Jackson Branch
Phase II (28 acres) Noncommercial gypsum area
Property line
Big Bend Road
SCALE

Source: TECO (1980c).

Figure 2-14. Disposal areas for bottom ash, fly ash, and gypsum.



Source: TECO (1979).

Figure 2-15. Heaped-fill configuration for the storage of gypsum.

2.7 EPA'S ENVIRONMENTALLY PREFERRED ALTERNATIVE AND RECOMMENDED ACTION

A decision to forego construction of Big Bend Unit 4 would apparently be preferable from an environmental standpoint. However, that there are major incentives to the issuance of a construction permit is clear from a consideration of economic findings presented in the FPSC order (Appendix G). These findings show that the needs of the peninsular Florida grid are not sufficient to justify the additional capacity, but that it is only through such an addition that TECO could meet its future service-area demands. Without Unit 4, TECO would have to purchase power from other utilities. Moreover, because the two major Florida utilities, the FPC and FP&L, have no capacity available from their certified units, the purchase of power from out-of-state utilities would probably be necessary. The FPSC has determined that this option would be neither cost- nor time-effective. It has also ascertained that the power from Unit 4 will substantially reduce the area's dependence on foreign oil for electric power generation. Based on the positive need for power, the findings of the FPSC, and EPA's evaluation of the impacts of the proposed project and alternatives, the EPA finds the project proposed by TECO to be environmentally acceptable.

The alternative preferred by the EPA is therefore as follows:

Management: Big Bend Unit 4

Fuel: Coal

Site: Big Bend

Waste heat rejection: Once-through cooling with fine-mesh screens on Units 3 and 4 (cooling water to be drawn from Hillsborough Bay)

Air emissions control:

Particulates--electrostatic precipitators

Sulfur dioxide--lime/limestone scrubbing with coal washing

Nitrogen oxide--boiler design

Residual solid waste disposal: Sale of fly ash and gypsum; provisions for onsite storage if necessary

Analyses demonstrate that the ambient levels of several metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead, selenium) in Hillsborough Bay and in the intake canal may violate State of Florida water-quality standards. Consequently, the discharge of certain effluents (boiler, bottom-ash, and FGD blowdowns) from Unit 4 as proposed would violate the water-quality standards. Control systems such as reverse osmosis and the chemical treatment of blowdowns are available to reduce the levels of metals in the effluents. While changes in the ambient water quality resulting from these discharges, treated or untreated, are mathematically predictable, they would be undetectable at the levels projected. TECO is pursuing a request for variance from the Florida water-quality standards with the Florida Department of Environmental Regulation and the EPA. The reevaluation of a filtration system to treat the metals is under consideration. The EPA considers this to be an acceptable approach to the discharge of plant effluents.

TECO's proposed method for the disposal of fly ash and gypsum is to sell these resources as construction materials. However, should the state of the economy shift, their sale may be impossible and onsite disposal may be required. TECO proposes to dispose of bottom ash at the site. The onsite disposal of these materials will cause leachate to enter the surficial ground water during periods of storm runoff. The fly-ash area will be lined with an impermeable material to prevent leachate contamination. The bottom-ash and gypsum areas will be unlined. Although the EPA considers the lining of these areas to be an environmentally preferable alternative, preliminary studies indicate that the leachability of these materials, particularly the gypsum, will be minimal. One condition of the NPDES permit is the development and implementation of an acceptable ground-water-monitoring program to preclude adverse impacts to the ground-water regime.

The assessment of environmental impacts associated with TECO's proposed project took into account mitigative measures that were not included as part of TECO's project proposal. Specifically EPA recommends that--

1. A ground-water-monitoring program be implemented before operation so that, should any significant contamination of ground water be demonstrated, corrective measures could be instituted to ensure no further significant leaching.

2. An erosion and sedimentation control program be implemented to prevent silt and soil-laden runoff during Unit 4 construction.

3. The mangrove area along the southwestern shoreline of the site be left undisturbed and protected as specified in TECO's proposed project.

4. A program to reduce impacts on the manatee, an endangered species, be implemented as suggested by the U.S. Fish and Wildlife Service (Appendix H).

5. Fine-mesh screens for Units 3 and 4 and the organism return system be installed and operational before Unit 4 pump testing.

6. A biological monitoring program be implemented to verify the efficiency of the full-scale fine-mesh screens and the organism return system.

The EPA tentatively proposes to issue an NPDES permit to TECO for Big Bend Unit 4. A draft of the proposed permit is presented in Appendix A. The project authorized by the permit is that described as TECO's proposed project in this document. This project will incorporate all measures identified as conditions of the permit (Part III conditions).

REFERENCES FOR CHAPTER 2

Environmental Science and Engineering, Inc. 1979. Site selection study for a coal-fired power plant 1985 commercial operation. Prepared for Tampa Electric Company. Gainesville, Florida.

TECO (Tampa Electric Company). 1979. Site certification application, Big Bend Station Unit 4.

TECO (Tampa Electric Company). 1980a. Site certification application, Big Bend Unit 4, Amendment 3.

TECO (Tampa Electric Company). 1980b. 316(A) & (B) Demonstration, Big Bend Station - Unit 4, Tampa Electric Company. 2 vols. Prepared by Stone & Webster Engineering Corporation, Boston, Massachusetts.

TECO (Tampa Electric Company). 1980c. Site certification application, Big Bend Unit 4, Amendment 4.

TECO (Tampa Electric Company). 1981. Site certification application, Big Bend Unit 4, Amendment 5.

Chapter 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 ATMOSPHERE

The effects of Big Bend Unit 4 on atmospheric conditions in the site region are considered below. Following a description of baseline conditions at Big Bend, attention is directed to construction impacts, operational impacts, and the specific impacts of cooling towers.

3.1.1 BASELINE CONDITIONS AT BIG BEND

Baseline atmospheric conditions in the site area are discussed in the following sections. Included for separate consideration are meteorological conditions, air quality, and noise.

3.1.1.1 Meteorology

Meteorological information is important for providing an overview of the environmental setting and for use as input to impact analyses. Baseline meteorological conditions at the Big Bend site are summarized in the following sections.

Regional Climatology

The climate of the site region is subtropical and is frequently affected by warm maritime air masses throughout the year and occasionally by cold, dry polar air masses during winter. The modifying effects of the Atlantic Ocean, the Gulf of Mexico, and Tampa Bay contribute to the relatively mild and humid winters and the very warm and very humid summers. Occasionally, cold air masses reach the region during the winter, resulting in freeze conditions.

The site region is within the northeast trade winds zone. Prevailing annual winds are from the east and are of light to moderate average speeds. However, wind directions are influenced locally by convectional forces inland and by land and sea breezes near the coast. The region is south of the major storm tracts that cross the United States; it is, however, subject to tropical storm activity and to frequent local convective thunderstorms.

Meteorological conditions for the site can be characterized by data from the National Weather Service station at Tampa International Airport (Tampa) and from the observation station at MacDill Air Force Base, the climatological observation stations nearest to the site in the region.

Monthly and annual temperature and precipitation normals, and other climatological information, are presented in Tables 3-1 and 3-2 for Tampa and MacDill, respectively. Approximately 60 percent of the annual precipitation occurs during June through September, when there are frequent convective thunderstorms and occasional tropical storms. Snowfall is negligible and freezing temperatures are rare. The annual daily temperature ranges from near 60°F in January to near 82°F in August. Heavy fog (visibility of 0.25 mile or less) occurs during 24 days on an annual basis. Average annual relative humidity is 74 percent. The region receives 66 percent of possible sunshine, and the mean daily insolation is approximately 450 langleys.

Annual wind roses for Tampa and MacDill are presented in Figure 3-1. Annual prevailing winds are from the east. Westerly winds become significantly more frequent from March through August. Wind speeds are at a minimum from July through September and highest from February through May.

Dispersion Conditions

The atmospheric transport and dispersion of emissions can be estimated on the basis of wind conditions and atmospheric stability. Data for Tampa and MacDill indicate that neutral conditions predominate throughout the year. Unstable conditions are relatively more frequent during the spring and summer. Annual prevailing winds are from the east, with mean speeds generally less than 9 miles per hour (for a sensor at a height of 22 feet). Winds from the east are quite frequent throughout the year. Westerly winds become significantly more frequent from March through August, although prevailing winds are still from the east.

Since the region as well as the site can be characterized as flat terrain, significant topographic effects on dispersion meteorology are not expected. However, atmospheric dispersion and transport conditions can be significantly affected by coastal meteorological processes.

3.1.1.2 Air Quality

The TECO service area lies within the West-Central Florida Intrastate Air Quality Control Region (AQCR; Citrus, Hardee, Hernando, Hillsborough, Levy, Manatee, Pasco, Polk, Pinellas, and Sumter Counties). The service area borders on the Southwest Florida Intrastate AQCR (Charlotte, Collier, DeSoto, Glades, Lee, Hendry, Highlands, and Sarasota Counties).

Portions of these AQCRs are "nonattainment" areas for national ambient air quality standards. A portion of Hillsborough County has been designated as nonattaining for suspended particulates and a portion of Pinellas County has been designated as nonattaining for sulfur oxides. The whole of Hillsborough and Pinellas Counties has been designated as nonattaining for ozone. The remaining counties or portions of counties are either "better than national standards" or "cannot be classified" for all regulated pollutants. Figure 3-2 shows the locations of the nonattainment areas for sulfur dioxide and total suspended particulates in relation to the Big Bend site, and National and State of Florida ambient air quality standards (AAQS) applicable to the site are presented in Table 3-3. The "significance of impact levels" for nonattainment areas are presented in Table 3-4.

Two portions of these AQCRs are classified as prevention of significant air quality deterioration (PSD) Class I areas, which are subject to the most stringent restraints on air quality deterioration. The closest Class I area is the Chassahowitzka National Wildlife Refuge located approximately 92 kilometers north of the Big Bend site in Hernando County. The other PSD Class I area is the Everglades National Park, approximately 250 kilometers south of the Big Bend site. The remaining AQCRs are classified as PSD Class II areas and thus are subject to less stringent restraints. The allowable increments by PSD class are presented in Table 3-5. Available ambient air monitoring data for the vicinity of Big Bend include information on baseline air quality conditions at the proposed site itself. An analysis of the monitoring data showed that the concentrations of sulfur dioxide, nitrogen oxides, and total suspended particulates did not exceed either national ambient air quality standards or State of Florida standards. Summaries of ambient air quality data are presented in Tables 3-6, 3-7, and 3-8.

3.1.1.3 Noise

The total noise at any location is a composite of sounds from many sources, both local and distant. In the vicinity of Big Bend Station, there are many sources of ambient noise: the Mineral Aggregates, Inc., plant east of the site, highway and railroad traffic, commercial and military aircraft, and the natural sounds of insects, rustling leaves, birds, and surf.

Local traffic and traffic on nearby U.S. Highway 41 are the dominant sources of noise off the plant site. Most of the measured increase in sound levels between 1974 and 1978 is attributable to the higher levels of activity and local traffic associated with the increased residential development in the vicinity of the plant. Although relatively constant, plant-operating noise levels are low throughout the site vicinity.

3.1.2 IMPACTS OF CONSTRUCTION ACTIVITIES

The most significant atmospheric impacts of Unit 4 construction will be the dust raised from disturbed land surfaces, the exhaust emissions of construction equipment and other motor vehicles, and the day-to-day noise endemic to heavy construction activity. A discussion of these impacts is provided in the following sections.

3.1.2.1 Dust

The construction of the proposed project will require approximately 38 months. During this period, ambient air quality in the vicinity of the site will be modified to an extent dependent on the nature of the construction activities. During dry periods, fugitive dust will be raised from untreated or unpaved road surfaces or unvegetated areas both by high winds and by the movement of heavy construction equipment.

The dust raised by construction vehicles will be controlled by the spraying of construction roads with water. Care will be taken to minimize overwatering, which could lead to the transport of mud onto adjoining roadways, thereby creating additional dust problems (Jutze and Axetell, 1974). Any dirt or dust-producing material that has been carried onto paved roadways will be promptly removed to reduce dust generation from these areas.

The use of dust retardants, windbreaks, dust fences, or temporary mulching to promote vegetation in dredged spoils and in other exposed soil areas will be considered where appropriate. The speed of mobile construction equipment will be controlled so as to minimize the abrasion and pulverization of the soil.

3.1.2.2 Emissions from Motor Vehicles and Construction Equipment

Concentrations of nitrogen oxides, carbon monoxide, suspended particulates, sulfur dioxide, and hydrocarbons will increase as a result of engine exhaust from construction equipment and automobiles used by the construction work force. These impacts will be minimized through the proper maintenance of engines and machinery. The effects are not expected to be serious.

3.1.2.3 Noise

Construction activity will generally be limited to the daylight hours, and even the predicted peak-construction sound levels (Table 3-9) are below the maximum permissible sound level, 60 decibels (dBA), specified in the Hillsborough County noise code.* It is estimated that construction sound levels will generally be lower than the existing residual ambient sound level (i.e., the sound level equaled or exceeded 90 percent of the time). In the residential area nearest the site (Location 6, Figure 3-3), equivalent and peak construction sound levels should be approximately 5 and 12 decibels higher, respectively, than the residual ambient level. These higher levels are not uncommon, however; existing noise sources presently produce similar variations from the residual level. Therefore, no serious impacts from onsite construction noise are expected in the surrounding private and public areas.

3.1.3 IMPACTS OF OPERATION

Atmospheric impacts of the operation of Unit 4 will include fugitive dust emissions owing to the transport, handling, and storage of coal; the emission of such pollutants as sulfur dioxide, particulate matter, nitrogen oxides, and carbon monoxide from the coal-fired boiler; and noise. A discussion of these impacts in turn is presented below.

3.1.3.1 Coal-Handling Facilities

Coal will be brought in by barge and routed through the existing barge-unloading, transfer/conveying, and storage pile-systems that service Units 1, 2, and 3. Unit 4 will require approximately 951,000 tons of coal per year. Figure 3-4 is a schematic of the route the additional coal will take at Big Bend. The numbers on the figure indicate emission sources. Potential (uncontrolled) and controlled fugitive emissions from the coal handling, estimated with the aid of the technical guidance document of the U.S. Environmental Protection Agency (EPA, 1977a), are 900 and 120 tons per year, respectively (Table 3-10).

Fugitive dust emissions from the receiving, handling, and storage of coal will be minimized by the turning of the reserve coal piles, which ensures uniform surface moisture; the containment and control of transfer points, conveyors, and crushing equipment; and the proper maintenance of coal-handling facilities.

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*Rules of the Hillsborough County Environmental Protection Commission, Chapter 1-10, Noise, adopted June 10, 1976.

3.1.3.2 Sulfur Dioxide Emissions

The system to control sulfur dioxide emissions from the coal-fired boiler must comply with the new-source performance standard (NSPS) of 1.2 pounds of sulfur dioxide per million British thermal units (Btu) and a 90 percent overall reduction in sulfur dioxide emissions. The sulfur dioxide emissions will range from 2592 to 5184 pounds per hour as long as the sulfur content of the coal ranges from 3 to 6 pounds per million Btu.

The air-quality impacts from the operation of Big Bend Unit 4 were determined by dispersion modeling. Three EPA-approved models were used: the Air Quality Display Model (AQDM, Briggs), the Point Multiple Model with wind shear effects (PTMTPW), and the CRSTER Single-Source Model.

The following scenarios were evaluated with respect to Big Bend in the sulfur dioxide short-term model:

1. All Big Bend units at 100 percent load
2. All Big Bend units at 75 percent load
3. All Big Bend units at 50 percent load
4. Big Bend Units 1, 2, and 4 only at 100 percent load (critical load found in cases 1, 2, or 3 above)
5. Big Bend Units 1 and 4 only at 100 percent load (critical load found in cases 1, 2, or 3 above)

The emissions and operating parameters of existing and proposed Big Bend units used in these scenarios are presented in Table 3-11. All emissions were at maximum allowable rates for both sulfur dioxide and particulate matter. The results of the sulfur dioxide modeling showed that maximum impacts would result from 100 percent load conditions.

The maximum annual sulfur dioxide concentration with all interacting sources is 18.5 micrograms per cubic meter, and it occurs toward downtown Tampa (Table 3-12). This is below the State of Florida AAQS of 60 micrograms per cubic meter. The predicted maximum 24-hour concentration is 145 micrograms per cubic meter. The 24-hour AAQS is 260 micrograms per cubic meter. The maximum 3-hour sulfur dioxide concentration due to the Big Bend facility is 1086.5 micrograms per cubic meter, which is below the 3-hour AAQS of 1300 micrograms per cubic meter.

The operation of Big Bend Unit 4 without Unit 3 is considered the worst-case emissions condition, since the stack exit velocity would be significantly reduced. For this scenario, the maximum annual average sulfur dioxide concentration is predicted to be 1.0 microgram per cubic meter (Table 3-12). The maximum 24-hour sulfur dioxide concentration would be 34.2 micrograms per cubic meter. The maximum 24-hour impact on the Pinellas County sulfur dioxide nonattainment area would be 4.0 micrograms per cubic meter, which is below the signifance level of 5 micrograms per cubic meter at which emission offsets are applicable. The maximum 3-hour sulfur dioxide concentration would be 163 micrograms per cubic meter. The impact on the

Pinellas County nonattainment area would be 17.0 micrograms per cubic meter, which is below the significance level of 25 micrograms per cubic meter.

The EPA has designated all airspace within 90 kilometers of Big Bend as a Class II PSD area. A summary of Class II PSD increment consumption is included in Table 3-13. The spatial sulfur dioxide increment consumption in the vicinity of Big Bend indicates uniform air quality improvement in relation to sulfur dioxide. Beyond 0.5 kilometer from Big Bend there is an improvement in 24-hour sulfur dioxide air quality. The magnitude of 3-hour sulfur dioxide PSD increment consumption is 67.7 micrograms per cubic meter, which is below the allowable PSD increment of 512 micrograms per cubic meter.

The Class I PSD area nearest Big Bend is the extreme southeastern edge of the Chassahowitzka Wilderness Area, which is located approximately 92 kilometers from the site. The predicted impacts of sulfur dioxide are below the significance-of-impact levels, which for sulfur dioxide short-term averaging times are identical with the Class I PSD increments. Therefore, it is expected that such impacts at a distance of 92 kilometers will be much less than the allowable Class I increments.

3.1.3.3 Emissions of Particulate Matter

The emissions of particulate matter from the boiler will be controlled by an electrostatic precipitator with a design specification of 0.03 pound per million Btu and 20 percent opacity. This will result in a particulate matter emission of 129.9 pounds per hour.

The maximum concentration of total suspended particulates attributable to the operation of Big Bend Units 1-4 is 3.7 micrograms per cubic meter, which is below the significance of impact level of 5 micrograms per cubic meter. Big Bend's compliance with AAQS for total suspended particulates is reflected in the projections of maximum ambient air quality impacts presented as Table 3-12.

The operation of Big Bend Unit 4 without Unit 3 is predicted to result in a maximum annual average concentration of total suspended particulates of much less than 1 microgram per cubic meter (Table 3-12). The maximum 24-hour particulate concentration would amount to 0.9 microgram per cubic meter. The Unit 4 source, therefore, is not expected to significantly impact particulate levels at the Hillsborough County nonattainment area, which is 5.3 kilometers north of the plant.

The maximum PSD increment consumption for total suspended particulates (24.0 micrograms per cubic meter) occurred 200 meters south of the Agrico facility. Agrico's impact is expected to be 25.4 micrograms per cubic meter; therefore, there is a slight improvement in air quality. Only slight deterioration (0.3 microgram per cubic meter) is expected beyond 0.3 kilometer.

3.1.3.4 Nitrogen Oxide Emissions

The nitrogen oxide emission standard restricts boilers firing bituminous coal to 0.60 pound per million Btu heat input and requires a 65 percent reduction in potential nitrogen oxide emissions. The emission of nitrogen oxides from the boiler will be controlled using a tangentially fired boiler having a design specification of 0.60 pound per million Btu and nitrogen oxide emissions of 2598 pounds per hour. The maximum annual nitrogen dioxide concentration from the operation of Big Bend Unit 4 is 0.5 microgram per cubic meter. This impact is below the level of significant impact (Table 3-14).

3.1.3.5 Carbon Monoxide Emissions

The emissions of carbon monoxide were determined using an EPA emission factor (EPA, 1977b) of 0.057 pound per million Btu. The resulting emissions for carbon monoxide are 2457 pounds per hour. The maximum 3-hour carbon monoxide impact (developed using maximum 3-hour sulfur dioxide impacts) is 7.8 micrograms per cubic meter. Although the predicted 3-hour carbon monoxide concentration could not be compared directly with the standards presented in Table 3-14, that concentration is so far below the level of significant impact that the resultant impacts will not violate AAQS.

3.1.3.6 Noise from Power-Plant Operation

All the sound levels due to the operation of Big Bend Units 1-4 (Table 3-15) are expected to meet or be below the maximum daytime (60 dBA) and nighttime (55 dBA) residential sound levels permissible under the Hillsborough County noise code. The estimated contributions of the plant to the continuous noise levels are less than the average nighttime residual sound levels at Locations 4, 5, and 8 (Figure 3-3). The estimated operational sound levels are also only 4 and 2 dBA greater than the nighttime residual ambient levels at Locations 6 and 7, respectively. The nighttime intermittent sound levels are expected to range from 3 to 10 dBA higher than the residual nighttime levels, and the daytime intermittent sound levels are expected to be as much as 17 dBA higher than the residual daytime levels. However, similar variations in ambient sound levels presently occur because of variations in existing ambient noise sources. Therefore, noise from the operation of Unit 4 is expected to have no significant impact on the surrounding private and public areas.

3.1.4 IMPACTS OF COOLING TOWERS

The potential atmospheric impacts of cooling towers include salt drift, ground-level fogging, and noise. In the following sections, these impacts are examined and a comparison of mechanical-draft, saltwater, and freshwater cooling towers is presented.

3.1.4.1 Saltwater Cooling Towers

Potential impacts on the atmosphere from the operation of a mechanical-draft cooling tower with saltwater makeup include the effects of salt drift, ground-level fogging, and increased noise levels.

Salt Drift

Salt drift from cooling towers may be considered a particulate emission and thus potentially subject to air quality regulations, including emission limitations, air quality standards, and PSD and emission offset regulations (Stone & Webster Engineering Corporation, 1979). Most states have regulations limiting the amount of particulates that may be emitted from a given source and some have applied these to cooling towers. Florida has set a limit on allowable particulate emissions from miscellaneous processes in terms of the process flow, and that limit is expressed in the following formula:

$$\text{Allowable emissions (lb/hr)} = 17.31P^{0.16} \qquad (3\text{-}1)$$

where P is the process flow (e.g., circulating-water flow) in tons per hour.

Given a circulating water-flow of 250,000 gallons per minute, the allowable emissions calculated by this formula would be about 100 pounds per hour. The total drift emission, using a drift rate of 0.002 percent and a circulating water salinity of 42 parts per thousand, would be about 105 pounds per hour. If an emission limitation based on this formula were applied to the cooling tower, the total drift emissions from the tower would have to be reduced by about 5 percent.

In addition to emission controls, ambient total suspended particulate concentrations are limited by national ambient air quality standards and PSD and emission offset regulations.

An indication of the contribution of cooling-tower drift to particulate concentrations is presented in Table 3-16. This table (developed from data presented in Table 3-17) shows the annual average and maximum 24-hour particulate concentrations in the worst sector for the mechanical-draft tower, using the results of the Salt Drift Model of Stone & Webster Engineering Corporation (1979). Two values are given, one for suspended particulates and one for total airborne particulates. Suspended particulates are defined as those smaller than 50 microns.

A second modeling study (Environmental Science and Engineering, Inc., 1980) using the Oak Ridge Fog and Drift Model (ORFAD; LaVerne, 1977) predicted the maximum annual average concentrations of airborne salt resulting from a mechanical-draft cooling tower at Big Bend. These data are presented in Table 3-18 for comparison.

Before definitive conclusions can be reached for Big Bend Unit 4, the combined effects of the stack, cooling towers, and other sources would have to be modeled together. The modeling would necessarily be based on a definition of suspended particles that would be acceptable to the appropriate regulatory agencies. The results of the modeling would then have to be compared to the "available" increment, which may be less than the total increment shown in Table 3-16.

Ground-Level Fogging*

The extent to which a mechanical-draft cooling tower would induce ground-level fogging was assessed using a mathematical model that predicts the configuration and frequency of visible plumes from cooling-tower operation. Unlike natural-draft towers, which discharge the visible plume at an elevation that precludes plume downwashing, mechanical-draft towers discharge at approximately 70 feet above ground level. Therefore, the effects of aerodynamic downwash on ground-level fogging potential must also be evaluated. The visible-plume analysis for the mechanical-draft tower is presented in Figure 3-5. The results suggest that the potential occurrence of ground fog will be infrequent and generally confined to the immediate site area. Icing resulting from ground fogging is expected to be rare because of the generally mild climate in the area.

Noise*

Along Newman Branch Road (Location 6, Figure 3-3), the residential area nearest to the site, studies were made to determine the sound levels that could be expected from the operation of a mechanical-draft cooling tower both alone and in conjunction with other plant equipment. It was established that the operation of the tower alone would produce a sound level at that location of 53 dBA, which meets the requirements of the Hillsborough County noise code. It was also found that, with appropriate noise control of the generating unit's induced-draft fans (and possibly its forced-draft fans), the operation of Big Bend Unit 4 with mechanical-draft cooling towers would produce total property-line sound levels no more than 1 or 2 dBA higher than those attributable to the cooling tower alone. This, too, is in conformity with the County's noise criteria.

3.1.4.2 Brackish-Water Cooling Towers

The impacts of this alternative would presumably be similar to those described for the saltwater cooling tower. However, drift effects should be less severe because of differences in the makeup water. The reduced content of dissolved solids in the water would allow for a higher concentration factor (ratio of solids in the circulating water to solids in the makeup water) and higher drift rates. Alternatively, with equivalent drift rates, the salt deposition would be less than with saltwater makeup.

3.1.4.3 Freshwater Cooling Towers

The impacts of this alternative should be similar to those described for the other types of cooling towers. Drift effects could be minimized, however, through the use of fresh water as makeup, the precise impacts depending on the concentration of dissolved solids in the drift.

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*Stone & Webster Engineering Corporation (1979).

Table 3-1. Climatological normals, means, and extremes for Tampa International Airport (National Climatic Center, 1979)

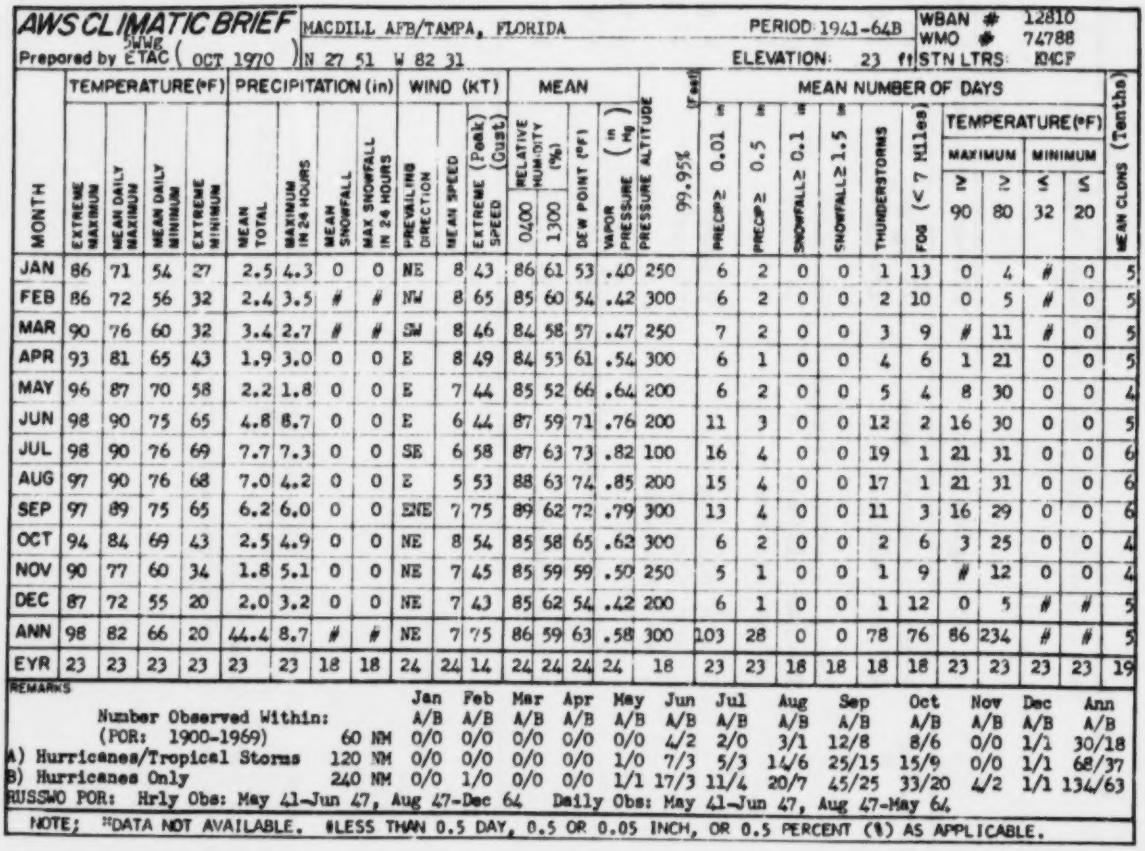
Month	Temperatures °F Normal Daily maximum	Temperatures °F Normal Daily minimum	Temperatures °F Normal Monthly	Temperatures °F Extremes Record highest	Year	Extremes Record lowest	Year	Normal Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs.	Year	Snow, Ice pellets Maximum monthly	Year	Maximum in 24 hrs.	Year	Relative humidity pct. Hour 01 (Local time)	Hour 07	Hour 13	Hour 19	Wind Mean speed m.p.h.	Prevailing direction	Fastest mile Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, tenths, sunrise to sunset	Mean number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility ½ mile or less	Temperatures °F Max. (b) 90° and above	Max. 32° and below	Min. 32° and below	Min. 0° and below	Average station pressure mb. Elev. 11 feet m.s.l.
(a)				32		32					32		32		32		32		32		15	15	15	15	32	14	26	26		32	32	32	32	32	32	32	32	32	15	15	15	15	6
J	70.0	50.8	60.4	86	1975	23	1971	203	60	2.33	8.02	1948	T	1950	3.29	1953	0.2	1977	0.2	1977	84	86	59	75	8.9	N	35	29	1959	63	5.6	9	11	11	6	0	1	6	0	0	2	0	1020.0
F	71.9	51.7	61.8	88	1971	24	1958	176	87	2.86	7.95	1963	0.21	1950	3.23	1963	T	1951	T	1951	81	84	55	69	9.5	E	50	32	1954	66	5.5	9	9	10	7	0	2	3	0	0	1	0	1019.6
M	76.1	55.9	66.0	91	1969	34	1967	90	121	3.89	12.64	1959	0.06	1956	5.20	1960	0.0		0.0		81	85	54	66	9.8	S	43	29	1936	71	5.5	10	10	11	7	0	3	3	0	0	0	0	1018.0
A	82.9	61.0	72.0	93	1975	40	1971	9	219	2.10	6.59	1957	T	1967	3.70	1951	0.0		0.0		81	86	49	60	9.6	ENE	37	29	1961	75	5.0	11	11	8	5	0	3	1	1	0	0	0	1018.2
M	87.5	66.9	77.2	98	1975	49	1971	0	378	2.41	8.13	1976	0.17	1973	4.10	1976	0.0		0.0		81	85	51	61	9.1	E	46	36	1958	74	5.3	10	12	9	6	0	6	1	8	0	0	0	1015.4
J	89.9	72.0	81.0	98	1977	61	1972	0	480	6.49	13.75	1974	1.06	1951	5.53	1974	0.0		0.0		83	85	59	67	8.3	E	67	31	1964	66	6.3	5	14	11	12	0	14	*	16	0	0	0	1016.3
J	90.1	73.7	81.9	97	1954	63	1970	0	524	8.43	20.59	1960	2.31	1962	12.11	1960	0.0		0.0		84	86	62	77	7.5	E	58	32	1963	61	6.9	2	16	13	16	0	21	*	19	0	0	0	1017.7
A	90.4	74.0	82.2	98	1975	67	1973	0	533	8.00	18.59	1949	2.35	1952	5.37	1949	0.0		0.0		86	90	63	76	7.3	ENE	38	11	1961	59	6.7	3	16	12	17	0	21	*	20	0	0	0	1017.4
S	89.0	72.6	80.8	96	1972	59	1956	0	474	6.39	13.04	1947	1.28	1972	4.67	1950	0.0		0.0		85	89	61	76	8.1	ENE	56	36	1960	60	6.5	4	14	12	13	0	12	*	15	0	0	0	1015.4
O	83.9	63.5	73.7	94	1950	40	1966	0	301	2.34	7.36	1952	0.23	1974	2.56	1968	0.0		0.0		84	87	56	71	9.0	NNE	38	02	1953	63	5.3	11	10	10	7	0	3	1	2	0	0	0	1016.8
N	77.1	56.4	66.8	90	1971	23	1970	71	123	1.79	6.12	1963	T	1960	4.22	1963	0.0		0.0		86	87	55	73	8.7	NNE	40	29	1963	65	4.9	12	9	9	5	0	1	3	*	0	*	0	1019.0
D	72.0	51.2	61.6	86	1978	18	1962	169	64	2.19	6.66	1950	0.21	1956	3.28	1969	0.0		0.0		84	86	58	74	8.8	N	45	36	1953	62	5.5	10	10	11	7	0	1	5	0	0	1	0	1019.5
YR	81.7	62.6	72.2	98	JUN 1977	18	DEC 1962	718	3364	49.38	20.59	JUL 1960	T	APR 1967	12.11	JUL 1960	0.2	JAN 1977	0.2	JAN 1977	83	86	57	69	8.7	E	67	31	JUN 1964	66	5.7	96	142	127	107	0	88	24	82	0	4	0	1017.8

Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Fastest mile wind 84 in September 1935.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

Table 3-2. Climatological normals, means, and extremes for MacDill Air Force Base (Environmental Technical Applications Center, 1970)



AWS CLIMATIC BRIEF MACDILL AFB/TAMPA, FLORIDA PERIOD: 1941-64B WBAN # 12810

Prepared by 5WWg ETAC (OCT 1970) N 27 51 W 82 31 ELEVATION: 23 ft WMO # 74788

STN LTRS: KMCF

MONTH	TEMPERATURE (°F)				PRECIPITATION (in)				WIND (KT)			MEAN				PRESSURE ALTITUDE	MEAN NUMBER OF DAYS						TEMPERATURE (°F)				MEAN CLDNS (Tenths)
	EXTREME MAXIMUM	MEAN DAILY MAXIMUM	MEAN DAILY MINIMUM	EXTREME MINIMUM	MEAN TOTAL	MAXIMUM IN 24 HOURS	MEAN SNOWFALL	MAX SNOWFALL IN 24 HOURS	PREVAILING DIRECTION	MEAN SPEED	EXTREME (Peak) (Gust) SPEED	RELATIVE HUMIDITY (%) 0400	RELATIVE HUMIDITY (%) 1300	DEW POINT (°F)	VAPOR PRESSURE (in Hg)	99.95% (Feet)	PRECIP ≥ 0.01 in	PRECIP ≥ 0.5 in	SNOWFALL ≥ 0.1 in	SNOWFALL ≥ 1.5 in	THUNDERSTORMS	FOG (< 7 Miles)	MAXIMUM ≥ 90	MAXIMUM ≥ 80	MINIMUM ≤ 32	MINIMUM ≤ 20	
JAN	86	71	54	27	2.5	4.3	0	0	NE	8	43	86	61	53	.40	250	6	2	0	0	1	13	0	4	#	0	5
FEB	86	72	56	32	2.4	3.5	#	#	NW	8	65	85	60	54	.42	300	6	2	0	0	2	10	0	5	#	0	5
MAR	90	76	60	32	3.4	2.7	#	#	SW	8	46	84	58	57	.47	250	7	2	0	0	3	9	#	11	#	0	5
APR	93	81	65	43	1.9	3.0	0	0	E	8	49	84	53	61	.54	300	6	1	0	0	4	6	1	21	0	0	5
MAY	96	87	70	58	2.2	1.8	0	0	E	7	44	85	52	66	.64	200	6	2	0	0	5	4	8	30	0	0	4
JUN	98	90	75	65	4.8	8.7	0	0	E	6	44	87	59	71	.76	200	11	3	0	0	12	2	16	30	0	0	5
JUL	98	90	76	69	7.7	7.3	0	0	SE	6	58	87	63	73	.82	100	16	4	0	0	19	1	21	31	0	0	6
AUG	97	90	76	68	7.0	4.2	0	0	E	5	53	88	63	74	.85	200	15	4	0	0	17	1	21	31	0	0	6
SEP	97	89	75	65	6.2	6.0	0	0	ENE	7	75	89	62	72	.79	300	13	4	0	0	11	3	16	29	0	0	6
OCT	94	84	69	43	2.5	4.9	0	0	NE	8	54	85	58	65	.62	300	6	2	0	0	2	6	3	25	0	0	4
NOV	90	77	60	34	1.8	5.1	0	0	NE	7	45	85	59	59	.50	250	5	1	0	0	1	9	#	12	0	0	4
DEC	87	72	55	20	2.0	3.2	0	0	NE	7	43	85	62	54	.42	200	6	1	0	0	1	12	0	5	#	#	5
ANN	98	82	66	20	44.4	8.7	#	#	NE	7	75	86	59	63	.58	300	103	28	0	0	78	76	86	234	#	#	5
EYR	23	23	23	23	23	23	18	18	24	24	14	24	24	24	24	18	23	23	18	18	18	18	23	23	23	23	19

REMARKS

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Number Observed Within:		A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B	A/B
(POR: 1900-1969)	60 NM	0/0	0/0	0/0	0/0	0/0	4/2	2/0	3/1	12/8	8/6	0/0	1/1	30/18
A) Hurricanes/Tropical Storms	120 NM	0/0	0/0	0/0	0/0	1/0	7/3	5/3	14/6	25/15	15/9	0/0	1/1	68/37
B) Hurricanes Only	240 NM	0/0	1/0	0/0	0/0	1/1	17/3	11/4	20/7	45/25	33/20	4/2	1/1	134/63

RUSSWO POR: Hrly Obs: May 41-Jun 47, Aug 47-Dec 64 Daily Obs: May 41-Jun 47, Aug 47-May 64

NOTE; *DATA NOT AVAILABLE. #LESS THAN 0.5 DAY, 0.5 OR 0.05 INCH, OR 0.5 PERCENT (%) AS APPLICABLE.

Table 3-3. National and State of Florida ambient air quality standards applicable to the proposed site, Hillsborough County, Florida[a]

Pollutant	Averaging time	National[b]		Florida[c]
		Primary standard	Secondary standard	
Suspended particulate matter	Annual geometric mean	75 µg/m^3	60 µg/m^3	60 µg/m^3
	24-hour maximum	260 µg/m^3	150 µg/$m^{3(d)}$	150 µg/$m^{3(d)}$
Sulfur dioxide	Annual arithmetic mean	80 µg/m^3	NA	60 µg/m^3
	24-hour maximum	365 µg/$m^{3(d)}$	NA	260 µg/$m^{3(d)}$
	3-hour maximum	NA	1300 µg/$m^{3(d)}$	1300 µg/$m^{3(d)}$
Carbon monoxide	8-hour maximum	9 ppm[d]	9 ppm[d]	9 ppm[d]
	1-hour maximum	35 ppm[d]	35 ppm[d]	35 ppm[d]
Hydrocarbons	3-hour maximum (6 to 9 a.m.)	0.24 ppm[d]	0.24 ppm[d]	0.24 ppm[d]
Nitrogen dioxide	Annual arithmetic mean	100 µg/m^3	100 µg/m^3	100 µg/m^3
Ozone	1-hour maximum	120 ppb[d]	120 ppb[d]	80 ppb[d]

Abbreviations:
µg/m^3 = micrograms per cubic meter.
NA = not applicable.
ppm = parts per million.
ppb = parts per billion.

[a] Adapted from Environmental Science and Engineering, Inc. (1979).
[b] Code of Federal Regulations, Title 10, Part 50, 1976, and FDER (1972).
[c] Florida Administrative Code, Chapter 17-2.
[d] Concentration not to be exceeded more than once per year.

Table 3-4. Federal and State of Florida levels of significant impact for sulfur dioxide and particulate matter (micrograms per cubic meter)[a]

Pollutant	Averaging time		
	Annual	24-hour	3-hour
Particulate matter	1	5	--
Sulfur dioxide	1	5	25

[a]From Environmental Science and Engineering, Inc. (1979).

Table 3-5. Federal and State of Florida prevention of significant deterioration allowable increments (micrograms per cubic meter)[a]

Pollutant/averaging time	Class		
	I	II	III
Particulate matter			
Annual geometric mean	5	19	37
24-hour maximum[b]	10	37	75
Sulfur dioxide			
Annual arithmetic mean	2	20	40
24-hour maximum[b]	5	91	182
3-hour maximum[b]	25	512	700

[a]From Environmental Science and Engineering, Inc. (1979).
[b]Increment can be exceeded once per year.

Table 3-6. Summary of data on continuous sulfur dioxide-monitoring in the vicinity of Big Bend Station[a]

Station	Location	Time period	24-hour		3-hour		Concentration ($\mu g/m^3$)				
			Number of observations	Percent data recovery	Number of observations	Percent data recovery	Arithmetic mean	Highest 24-hr		Highest 3-hr	
								NOL	RUN	NOL	RUN
T1	East Bay substation	2/77-4/79	708	87.4	5687	87.7	12	156	172	965	967
T4	Bullfrog Creek	5/77-4/79	639	88.8	5103	88.6	10	237	237	1149	1206
T5	North Ruskin	2/77-4/79	722	89.1	5784	89.3	14	135	174	767	967
T7	Apollo Beach	2/77-4/79	450	75.0	3670	63.7	16	135	211	473	520
T8	Gibsonton	2/77-3/78	397	94.5	3191	95.0	15	99	104	588	650
				State of Florida standard			60		260		1300
				EPA secondary standard			—		—		1300
				EPA primary standard			80		365		—

Abbreviations:
$\mu g/m^3$ = micrograms per cubic meter.
NOL = nonoverlapping averages.
RUN = running averages.

[a] Adapted from Environmental Science and Engineering, Inc. (1979)

Table 3-7. Summary of ambient 24-hour suspended particulate matter data in the vicinity of Big Bend Station, 1976-1978[a]

Station	Sponsor	Time period	Number of observations	Sulfur dioxide concentration ($\mu g/m^3$) Geometric mean	Maximum 24-hour	Second-highest 24-hour	Geometric deviation
5	TECO	1/76-12/76	49	41	143	71	1.54
		1/77-12/77	30	38	103	87	1.96
6	TECO	1/76-12/76	47	36	70	69	1.41
		1/77-12/77	40	37	115	81	1.54
		1/78-12/78	15	39	64	61	1.38
12	TECO	1/76-12/76	6[b]	28	65	49	2.62
		1/77-12/77	45	37	111	71	1.48
		1/78-12/78	49	39	86	78	1.45
17	TECO	1/78-12/78	31	33	79	55	1.37
9	HCEPC	1/76-12/76	57	38	85	76	1.38
		1/77-12/77	54	31	74	55	1.40
		1/78-12/78	61	36	97	70	1.43
50	HCEPC	1/76-12/76	54	31	61	57	1.39
		1/77-12/77	52	32	79	69	1.47
		1/78-12/78	61	38	109	96	1.53
54	HCEPC	1/76-12/76	61	38	66	64	1.35
		1/77-12/77	58	38	110	103	1.56

Abbreviations:
TECO = Tampa Electric Company.
$\mu g/m^3$ = micrograms per cubic meter.
HCEPC = Hillsborough County Environmental Protection Commission.

[a] Adapted from Environmental Science and Engineering, Inc. (1979).
[b] Sampling not conducted for the entire year.

Note: Federal primary standards--260 $\mu g/m^3$, 24-hour average (not to be exceeded more than once per year).
75 $\mu g/m^3$, annual geometric mean.
State of Florida standards--150 $\mu g/m^3$, 24-hour average (not to be exceeded more than once per year).
60 $\mu g/m^3$, annual geometric mean.

Table 3-8. Summary of ambient 24-hour nitrogen dioxide bubbler data in the vicinity of TECO Big Bend, 1976-1978[a]

Station	Time period	Number of observations	Nitrogen dioxide concentration (μg/m^3) Arithmetic mean	Nitrogen dioxide concentration (μg/m^3) Maximum 24-hour
5	1/76-12/76	133	13	42
	1/77-12/77	79	22	52
	1/78-12/78	87	37	221
6	1/76-12/76	135	12	43
	1/77-12/77	91	17	39
	1/78-12/78	26	20	47
11	1/76-12/76	20[b]	17	37
	1/77-12/77	95	17	43
	1/78-12/78	57	29	101
13	1/76-12/76	16[b]	15	30
	1/77-12/77	94	11	33
	1/78-12/78	56	28	129
15	1/76-12/76	8[b]	15	24
	1/77-12/77	71	13	27
	1/78-12/78	59	26	121
17	1/76-12/76	3[b]	18	22
	1/78-12/78	75	38	165
18	1/76-12/76	1[b]	5	5
	1/77-12/77	96	18	37
	1/78-12/78	27	23	111

Abbreviations:
TECO = Tampa Electric Company.
μg/m^3 = micrograms per cubic meter.

[a] Adapted from Environmental Science and Engineering, Inc. (1979)
[b] Sampling not conducted for the entire year.

Note: Federal primary and State of Florida standard: 100 μg/m^3, annual arithmetic mean.

Table 3-9. Predicted sound levels from the construction of Big Bend Station Unit 4[a,b]

Ambient-sound-level monitoring location[c]	Daytime ambient residual sound level[d]	Equivalent construction sound level (L_{eq})	Peak-construction sound level (L_1)
Location 4 7500 ft NE at Adamsville	46	38	46
Location 5 3800 ft ESE at Big Bend Road	53	48	56
Location 6 4000 ft S at Newman Branch Road	43	47	55
Location 7 8000 ft SSW at Apollo Beach Road	43	37	45
Location 8 8000 ft SW at Apollo Beach Motel	45	37	45

[a] Adapted from TECO (1979).

[b] dBA referenced to 0.0002 microbar.

[c] Monitoring network is depicted in Figure 3-3.

[d] Average of daytime values obtained during survey of January 16, 17, and 18, 1978.

Table 3-10. Summary of fugitive-dust emissions from coal handling at Big Bend Station[a]

Process	Emission source	Source number[c]	Basic emission factor[b] (lb/ton)	Annual potential emissions (tons)	Control efficiency (%)	Annual controlled emissions (tons)
Barge unloading	Bucket elevator	1	0.4	190.2	90.0	19.0
Transfer/conveying to storage piles (existing)	Transfer tower A					
	A belt to B belt	2	0.2	95.1	95.0	4.8
	B belt to surge hopper	3	0.2	95.1	95.0	4.8
	Surge hopper to C belt	4	0.2	95.1	95.0	4.8
	C belt to D belt	5	0.2	95.1	95.0	4.8
	Transfer tower 1	6	0.2	95.1	95.0	4.8
	Transfer tower 2	7	0.2	95.1	95.0	4.8
	Stacker/reclaimer	8	0.2	95.1	95.0	4.8
Storage piles (existing)	Loadon, loadout, wind erosion, vehicular traffic	9	0.074	35.2	34.6	23.0
Transfer/conveying to surge pile	Surge hopper to H belt	10	0.2	95.1	95.0	4.8
	H belt to F belt	11	0.2	95.1	95.0	4.8
	Transfer tower 3	12	0.2	95.1	95.0	4.8
Surge pile (existing)	Loadon, loadout, wind erosion, vehicular traffic	13	0.074	35.2	12.0	31.0

[a] Adapted from Environmental Science and Engineering, Inc. (1979).
[b] Represents potential or uncontrolled emissions.
[c] The emission sources are indicated in Figure 3-4.

Table 3-11. Plant PSD operating and pollutant-emission parameters for Big Bend Units 1-4[a]

Unit/load percentage	Generation (MW)	Heat-input rate (10^6 Btu/hr)	Flue-gas rate (1000 acfm)	Flue-gas temperature (°F)	Stack height (ft)	Stack ID (ft)	SO_2[b]	Emissions (lb/hr) of particulate matter[c]	NO_x
Unit 1									
100%	362	4037	1276	301	490[d]	24[e]	20,936	404	2826
75%	272	3142	1020	282	--	--	15,702	302	2202
50%	191	2143	724	261	--	--	10,468	202	1500
Unit 2									
100%	338	3996	1276	301	--	--	20,723	400	2797
75%	254	3110	1020	282	--	--	15,543	300	2177
50%	169	2122	724	261	--	--	10,362	200	1485
Unit 3									
100%	362	4115	1285	292	490[d]	24[e]	21,341	411	2881
75%	272	3203	999	268	--	--	16,005	309	2249
50%	191	2185	693	249	--	--	10,670	206	1530
Unit 4									
100%	417	4330	1778	156	--	--	5,630[e]	141[f]	2598[f]
75%	313	3244	1422	156	--	--	4,223	106	1946
50%	209	2241	1013	156	--	--	2,815	70	1345

Abbreviations:

PSD = prevention of significant deterioration.
MW = megawatt.
Btu/hr = British thermal units per hour.
acfm = absolute cubic feet per minute.
ID = internal diameter.
SO_2 = sulfur dioxide.
NO_x = nitrogen oxides.

[a] Adapted from Environmental Science and Engineering, Inc. (1979).

[b] Emissions apportioned by heat-input rate. Emission rates computed for Units 1-3 on the basis of 31.5 tons per hour and for Unit 4 on the basis of 1.2 pounds per million Btu.

[c] Emission rates computed for Units 1-3 on the basis of 0.1 pound per million Btu and for Unit 4 on the basis of 0.03 pound per million Btu.

[d] Common stack for Units 1 and 2.

[e] Common stack for Units 3 and 4.

[f] Based on a maximum heat-input rate of 46,920,000 Btu/hr.

Table 3-12. Maximum air-quality impacts (micrograms per cubic meter) at the Big Bend site with Unit 4 operating[a]

Case	Annual		24-hour[b]		3-hour
	SO_2	TSP	SO_2	TSP	SO_2
Attainment-area impacts					
Big Bend Unit 4 only	≪1	≪1	34.2	0.9	163
Big Bend Units 1-4	8.5	0.2	185	3.7	1087
With all interacting sources	18.5	69.2[c]	82	128.1[d]	992
State of Florida AAQS	60	60	260	150	1300
Nonattainment-area impacts[e]					
Big Bend Unit 4 only	≪1	≪1	4	0.4	17
Significance-of-impact level	1	1	5	5	25

Abbreviations:
SO_2 = sulfur dioxide.
TSP = total suspended particulates.
AAQS = ambient-air-quality standard.

[a] Adapted from Environmental Science and Engineering, Inc. (1979).

[b] Not to be exceeded more than once per year.

[c] Includes background concentration of 35 micrograms per cubic meter. Modeling violation only.

[d] Includes background concentration of 55 micrograms per cubic meter.

[e] Sulfur dioxide impact at Pinellas County nonattainment area and impact of total suspended particulates at Hillsborough County nonattainment area.

Table 3-13. FDER prevention of significant deterioration maximum increment consumption (micrograms per cubic meter) at the Big Bend site[a]

Case	Annual[b]		24-hour[c]		3-hour[c]
	SO_2	TSP	SO_2	TSP	SO_2
Big Bend Units 1-4 only	0.0	0.0	-4.4	0.3	67.7
With all interacting sources					
Projected	8.0	34.3	20.3	3.7	824.1
Baseline	21.0	10.0	24.7	0.0	756.4
Increment consumption	-13.1	24.3[d]	-4.4	3.7	67.7
EPA allowable Class II increment	20	19	91	37	512

Abbreviations:

FDER = Florida Department of Environmental Regulation.
SO_2 = sulfur dioxide.
TSP = total suspended particulates.
EPA = U.S. Environmental Protection Agency.

[a] Adapted from Environmental Science and Engineering, Inc. (1979).
[b] Includes all sources within a 50-kilometer radius.
[c] Includes all sources within a 15-kilometer radius plus other major sources.
[d] Modeling violation only.

Note: Minus values indicate air-quality improvement.

Table 3-14. Maximum air-quality impacts for nitrogen dioxide and carbon monoxide (micrograms per cubic meter) from Big Bend Unit 4[a]

Pollutant	Maximum air quality impact		Level of significant impact			State of Florida AAQS		
	Annual	3-hour	8-hour	Annual	1-hour	8-hour	Annual	1-hour
Nitrogen dioxide	0.5	--	--	1.0	--	--	100	--
Carbon monoxide	--	7.8	500	--	2,000	10,000	--	40,000

Abbreviation: AAQS = ambient air quality standards.

[a] Adapted from Environmental Science and Engineering, Inc. (1979).

Table 3-15. Predicted maximum sound levels from the operation of Big Bend Unit 4[a,b]

Ambient-sound-level-monitoring locations[c,d]	Ambient residual sound levels[c]		Units 1, 2, 3 (combined) continuous sound level	Unit 4 continuous sound level	Units 1, 2, 3, 4 (combined) continuous sound level	Units 1, 2, 3, 4 (combined) intermittent sound level	
	Day	Night				Day	Night
Location 4 7500 ft NE at Adamsville	46	43	36	39	41	46	46
Location 5 3800 ft ESE at Big Bend Road	53	52	45	46	49	56	55
Location 6 4000 ft S at Newman Branch Road	43	44	44	45	48	60	54
Location 7 8000 ft SSW at Apollo Beach Road	43	37	35	36	39	47	45
Location 8 8000 ft SW at Apollo Beach Motel	45	42	35	36	39	45	45

[a] Adapted from TECO (1979).

[b] dBA referenced to 0.0002 microbar.

[c] Average of values obtained during survey of January 16, 17, and 18, 1978.

[d] The monitoring network is depicted in Figure 3-3.

Table 3-16. Applicant's drift predictions and Class II PSD increments for a mechanical-draft cooling tower with saltwater makeup[a],[b]

Measurement	Drift prediction		Class II PSD increments
	Suspended	Total	
Maximum annual average	0.05	5.88	19 (annual geometric mean)
Maximum for 24 hours	4.52	76.4	37 (24-hour maximum)

Abbreviation: PSD = prevention of significant deterioration.

[a] Adapted from Stone & Webster Engineering Corporation (1979).
[b] All values in micrograms per cubic meter.

Table 3-17. Results of drift predictions for a mechanical-draft cooling tower[a]

Parameter	Annual	Location		Monthly	Location		Daily	Location		Hourly	Location	
		Distance (ft)	Sector		Distance (ft)	Sector		Distance (ft)	Sector		Distance (ft)	Sector
Maximum salt-deposition rate (lb/acre-period)	1,270	750	NW	274.1	750	NW	—	—	—	—	—	—
Maximum water-deposition rate (lb/acre-period)	23,220	750	NW	—	—	—	—	—	—	—	—	—
Maximum suspended-salt concentration (μg/m^3)	0.0549	3250	SW	—	—	—	4.52	2750	WSW	33.3	5000	SE
Maximum airborne-salt concentration (μg/m^3)	5.88	750	NW	15.3	750	NW	76.4	500	SW	345	500	N

Abbreviation: μg/m^3 = micrograms per cubic meter.

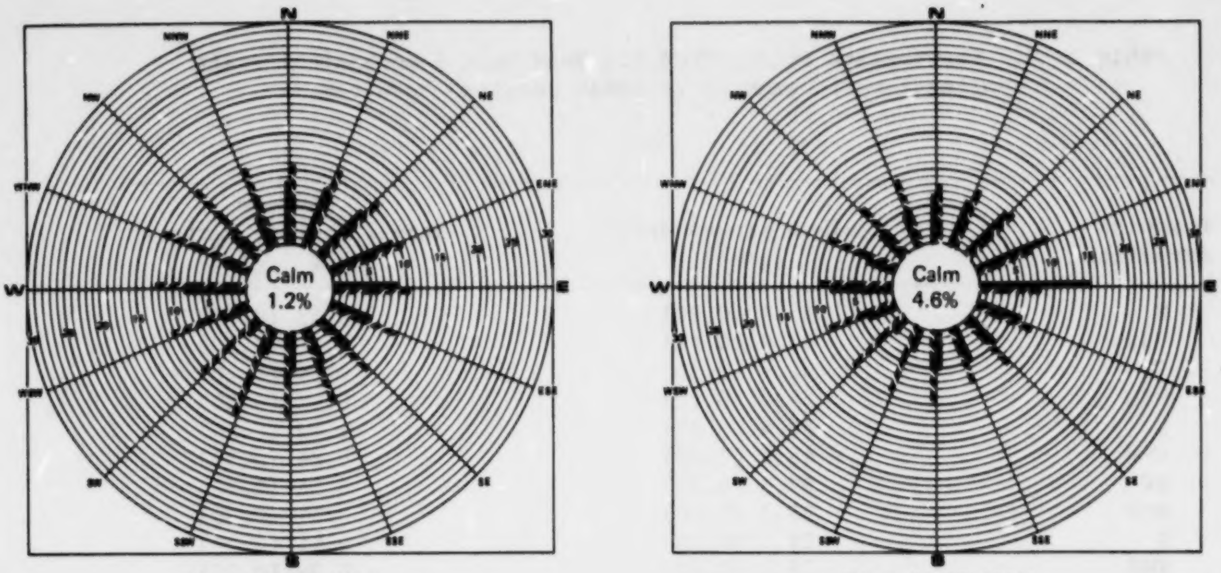
[a] Adapted from Stone & Webster Engineering Corporation (1979).

Table 3-18. Particulate drift, TECO Big Bend Unit 4 mechanical-draft cooling tower: summary or ORFAD modeling results[a]

Downwind direction	Maximum annual drift (g/m^2)	Maximum annual average airborne salt $(\mu g/m^3)$
S	25.4 (0.20)	0.47 (0.20)
SSW	22.0 (0.20)	0.40 (0.20)
SW	32.9 (0.20)	0.59 (0.20)
WSW	53.6 (0.20)	0.95 (0.20)
W	83.4 (0.20)	1.49 (0.20)
WNW	46.9 (0.20)	0.84 (0.20)
NW	30.6 (0.20)	0.55 (0.20)
NNW	28.3 (0.20)	0.51 (0.20)
N	29.6 (0.20)	0.54 (0.20)
NNE	18.4 (0.20)	0.34 (0.20)
NE	15.3 (0.20)	0.28 (0.20)
ENE	18.0 (0.20)	0.33 (0.20)
E	41.4 (0.20)	0.77 (0.20)
ESE	19.0 (0.20)	0.35 (0.20)
SE	23.1 (0.20)	0.42 (0.20)
SSE	20.9 (0.20)	0.38 (0.20)

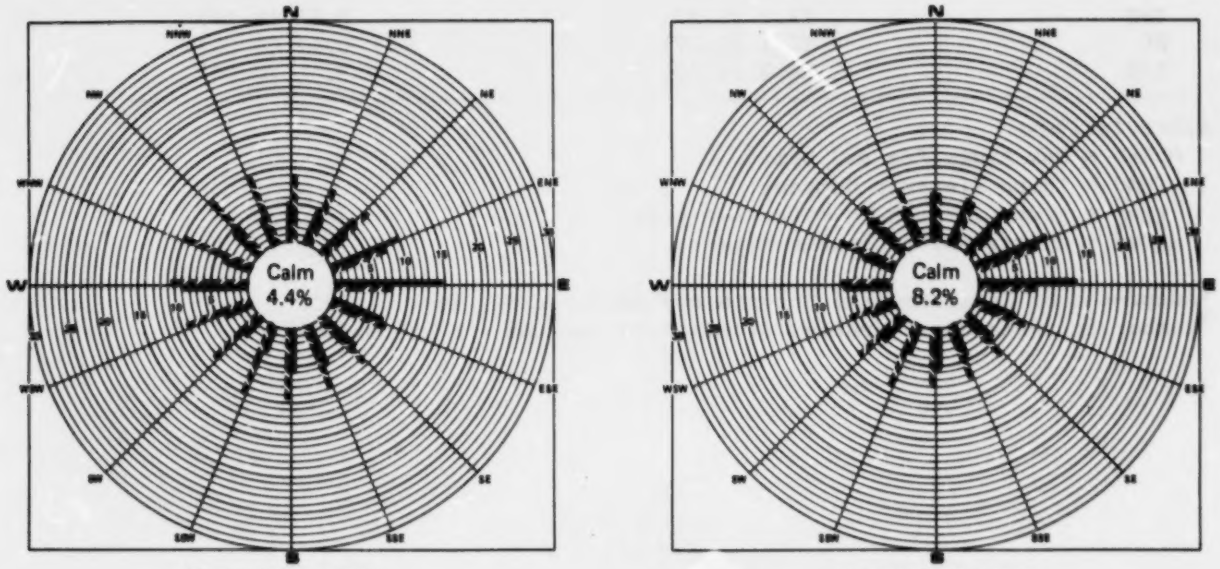
Abbreviations:
ORFAD = Oak Ridge Fog and Drift.
TECO = Tampa Electric Company.
g/m^2 = grams per square meter per year.
$\mu g/m^3$ = micrograms per cubic meter.

[a] Adapted from Environmental Science and Engineering, Inc. (1980).
[b] Number in parentheses denotes distance to maximum (in kilometers).



Tampa (1960-1964)

Tampa (1965-1969)

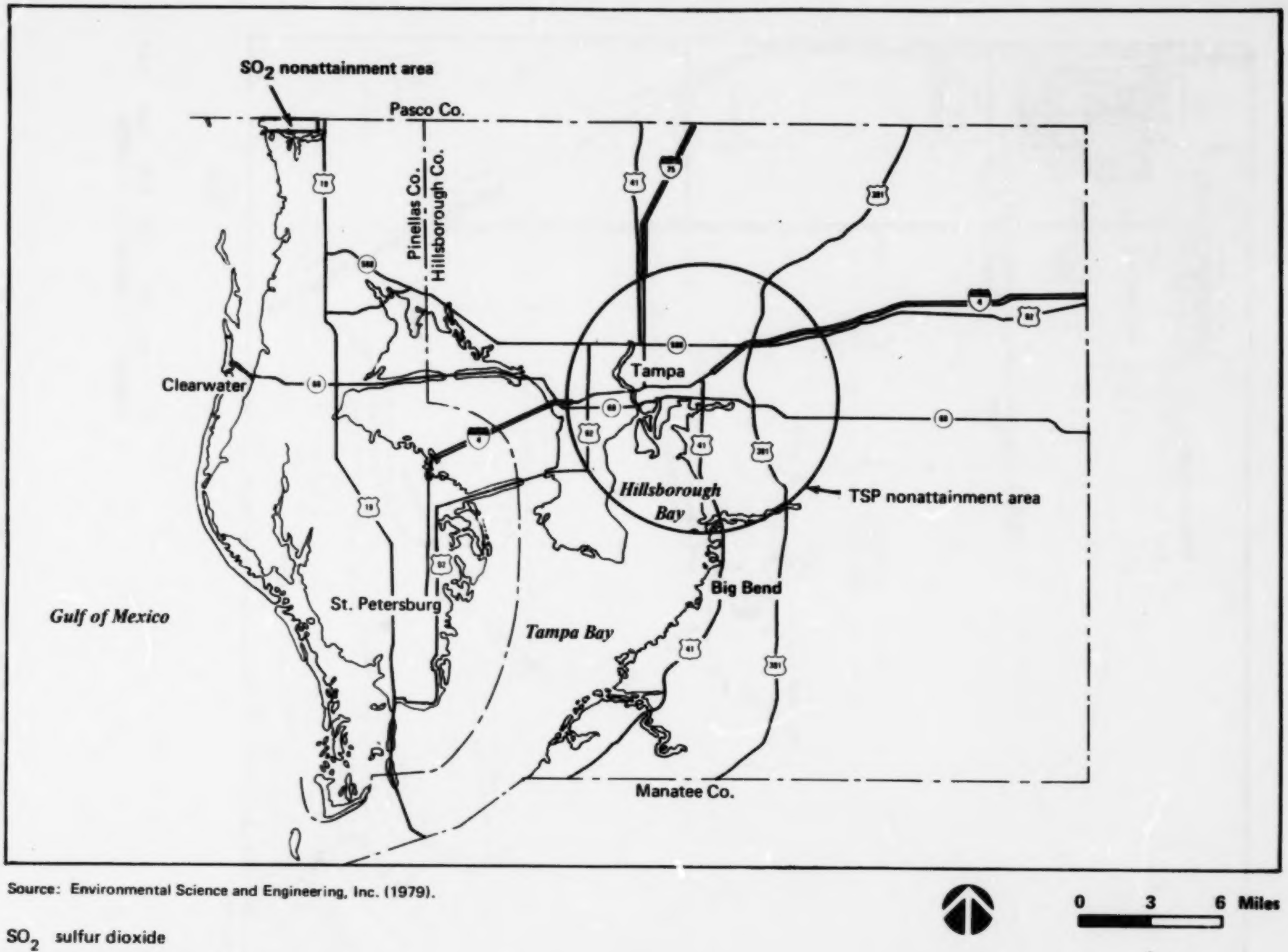


Tampa (1971-1975)

MacDill (1965-1969)

▬▬ Wind direction frequency (%)
- - - - Mean wind speed (mph)

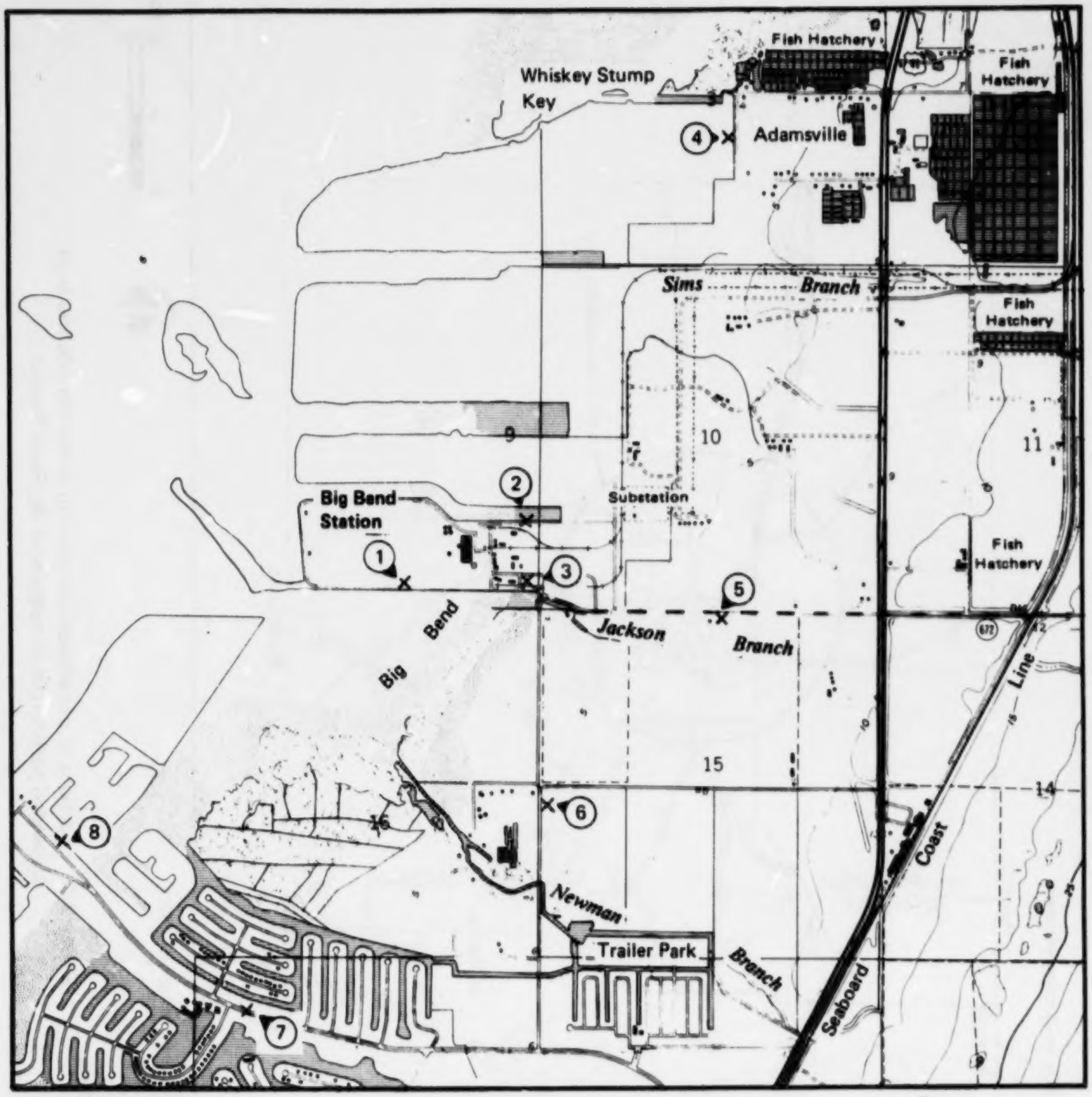
Figure 3-1. Annual wind roses for Tampa and MacDill.


SO$_2$ nonattainment area
Pasco Co.
Pinellas Co.
Hillsborough Co.
Clearwater
Tampa
Hillsborough Bay
TSP nonattainment area
Big Bend
St. Petersburg
Gulf of Mexico
Tampa Bay
Manatee Co.
19
41
75
301
60
4
92
0
3
6 Miles

Source: Environmental Science and Engineering, Inc. (1979).

SO$_2$ sulfur dioxide
TSP total suspended particulates

Figure 3-2. Locations of nonattainment areas for sulfur dioxide and total suspended particulates in relation to Big Bend Station.

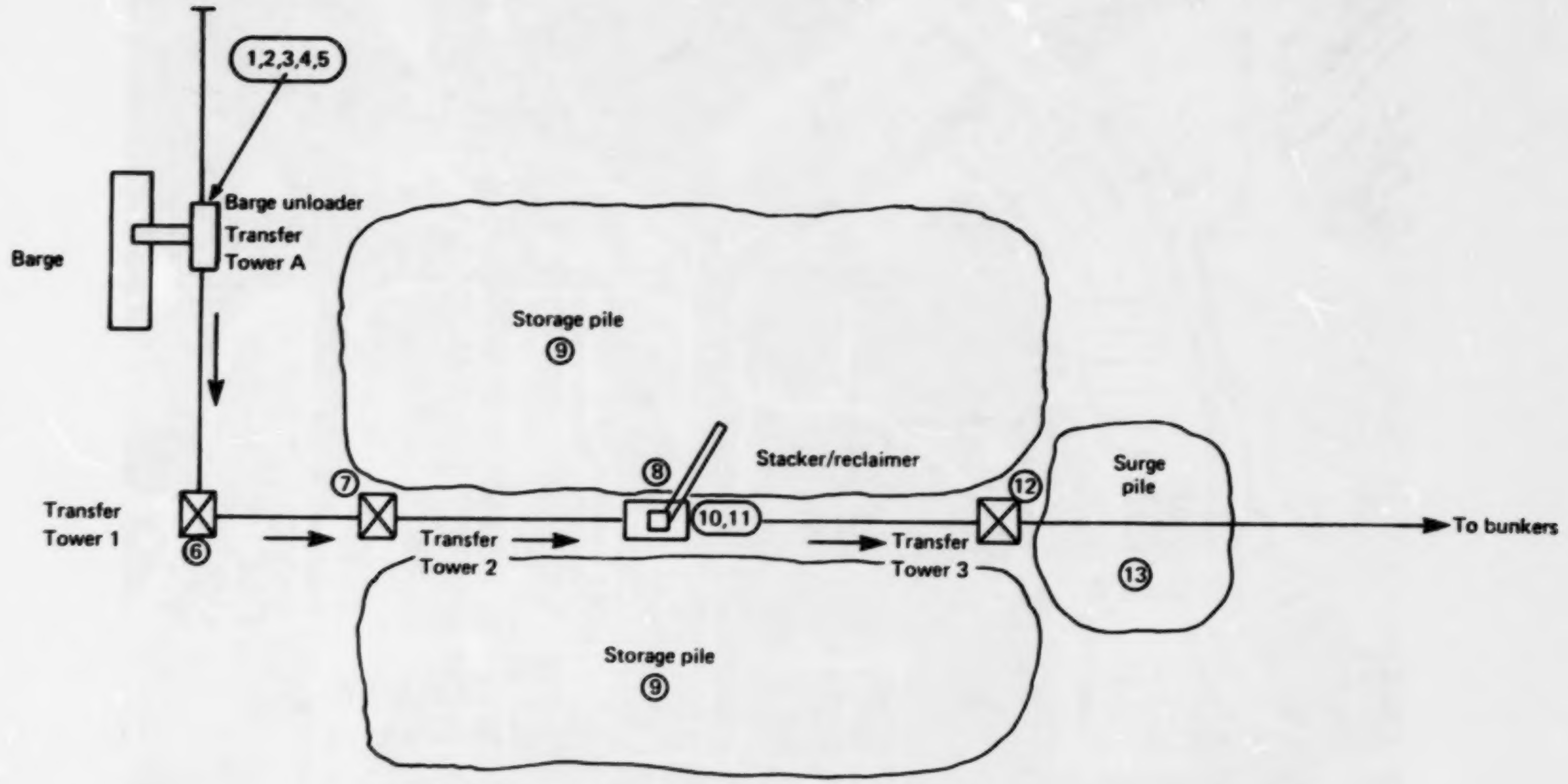


Fish Hatchery
Fish Hatchery
Whiskey Stump Key
4
Adamsville
Sims Branch
Fish Hatchery
9
10
11
2
Big Bend Station
Substation
1
3
Fish Hatchery
5
Jackson Branch
672
Big Bend
Line
15
14
6
8
16
Coast
Newman
Trailer Park
Branch
7
Seaboard

Source: TECO (1979).

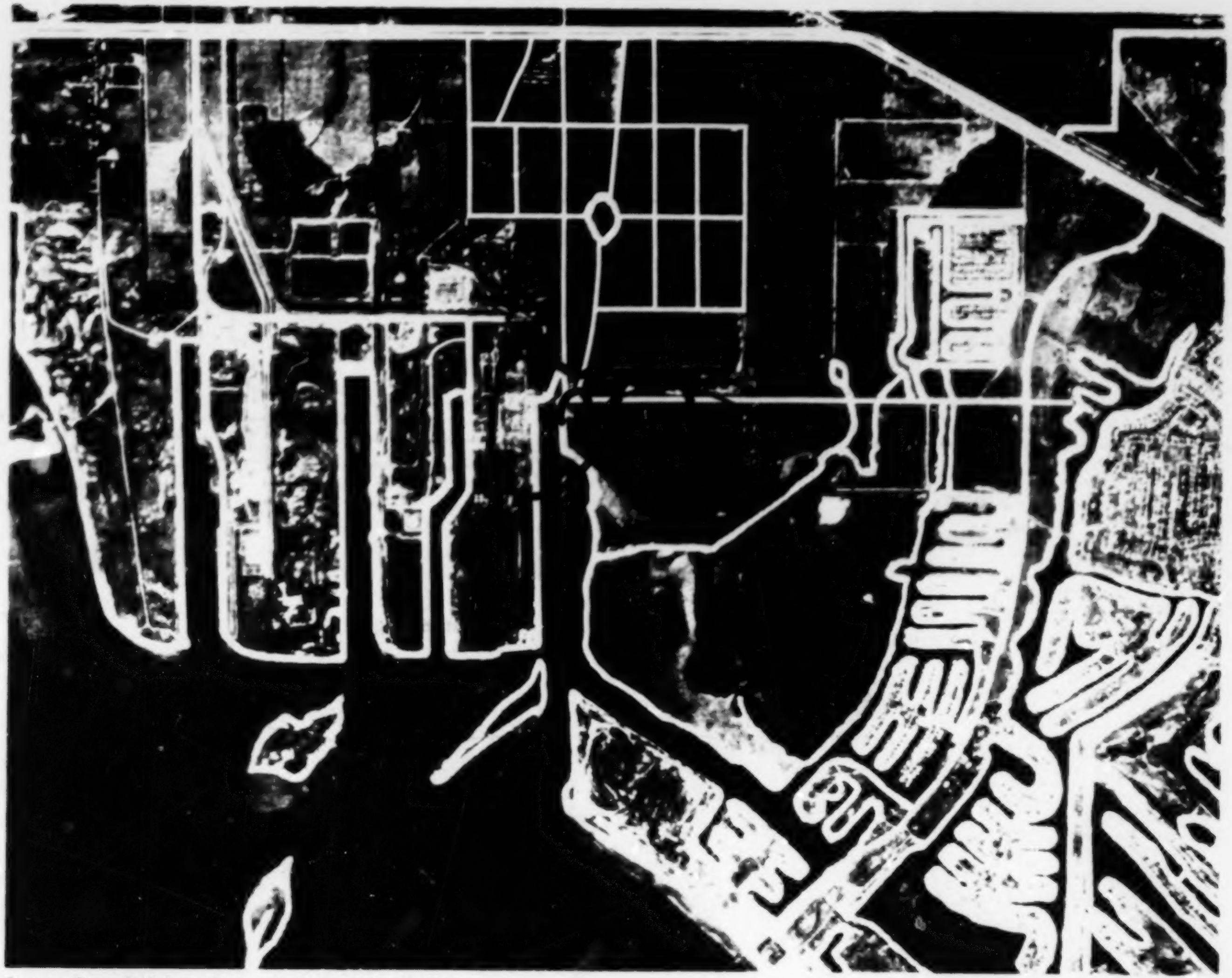
0 100 200 300 400 500 Feet

Figure 3-3. Ambient-sound-level-monitoring locations at Big Bend Station.


1,2,3,4,5
Barge
Barge unloader
Transfer
Tower A
Storage pile
9
Stacker/reclaimer
8
7
12
Surge pile
Transfer
Tower 1
6
Transfer
Tower 2
10,11
Transfer
Tower 3
To bunkers
13
Storage pile
9

Source: Environmental Science and Engineering, Inc. (1979).

Figure 3-4. Schematic of Big Bend coal-handling facilities and emission sources.



Source: Stone & Webster Engineering Corporation (1979).

Figure 3-5. Percent frequency of potential ground fog resulting from the operation of a mechanical-draft cooling tower at the Big Bend power plant.

3.2 LAND

The following is a discussion of the impacts of the proposed Big Bend Unit 4 on both the terrain and the terrestrial ecology in the site area. After a review of baseline conditions at Big Bend, the effects of the construction and operation of the generating unit are examined in turn. Separate consideration is given to the impacts of the operation of a mechanical-draft cooling tower.

3.2.1 BASELINE CONDITIONS AT BIG BEND

The geologic setting and the terrestrial ecology of the Big Bend area are examined in the sections that follow. Under terrestrial ecology, separate consideration is given to regional flora, fauna, and mammalian species.

3.2.1.1 Geologic Setting

The Big Bend site is located on artificial fill dredged from the bottom soils of Tampa Bay. Unconsolidated materials consisting of sand, shells, limestone, silt, clay, and calcareous clay, which were deposited during Pleistocene time (approximately 1 million years ago), lie beneath the artificial fill (Figure 3-6). These materials overlie layered sedimentary rocks in two formations of Miocene age (approximately 25 million years old), the Hawthorn Formation and the Tampa Formation. These formations are composed principally of carbonate rocks, although the Hawthorn Formation contains a number of uncemented sediments.

The most useful scheme for classifying the surficial soils involves the use of soil associations, three of which occur at the Big Bend site. The Ruskin-Sunniland-Bradenton association covers approximately 70 percent of the Big Bend site area, and the saltwater swamp and marsh association covers about 25 percent. The remaining area is covered by the Ona-Scranton-Leon association.

Few earthquakes have occurred in or near Florida since the earliest recorded earthquake in the area in 1663. The U.S. Coast and Geodetic Survey has designated Florida as a Zone 0 area, a zone of little or no probability of earthquake damage.

3.2.1.2 Terrestrial Ecology

Surveys of terrestrial flora and fauna were conducted at Big Bend Station under the direction of Dr. R. W. Long, Professor of Botany, University of South Florida, from March through May 1972. Additional terrestrial studies were carried out from March 1974 through May 1975 and from August through October 1977. The results of these studies were used as baseline data for the assessment of the environmental impact of the proposed Big Bend Unit 4. In addition to the data base generated in these programs, the available literature regarding the terrestrial ecology of central Florida was used in preparing the descriptions presented below.

Flora

The Big Bend site encompasses approximately 1,675 acres on the eastern shore of Hillsborough Bay. The distribution and areal extent of land use and vegetation cover types on the site, as determined from 1977 aerial photography, are presented in Figure 3-7. The photographic data showed that approximately 30 percent of the site (mostly dredge-and-fill land) was committed to construction, electric-power-generating units, and associated facilities; 18 percent supported natural vegetation cover; 24 percent was improved or unimproved pastureland for cattle; 19 percent was intermixed with ponds and marsh; 1 percent was devoted to private residences; and 8 percent had other combined uses.

The natural vegetation at Big Bend has been greatly disturbed by human activities such as logging, cultivation, cattle grazing, construction, and the maintenance of transmission corridors. Consequently, the majority of vascular plants are ruderal.

Brief characterizations of vegetation types observed on the site during the 1974-1975 survey are presented in the following paragraphs.

Agricultural Land. Agricultural land was approximately 24 percent of the Big Bend site and included both cultivated fields and pastureland for cattle. Principal crops grown in the vicinity of the site included commercial vegetables, tomatoes, and strawberries. The pasture (Area 9, Figure 3-7) contained at least 30 species of plants. The lower stratum was dominated by water pennywort (*Hydrocotyle umbellata*), crabgrass (*Digitaria adscendens*), tick clover (*Desmodium canum*), coinwort (*Centella asiatica*), sedge (*Cyperus tenuifolius*), and bahiagrass (*Paspalum notatum*). Wax myrtle (*Myrica cerifera*), saltbush (*Baccharis halimifolia*), Brazilian pepper (*Schinus terebinthefolius*), and shrub verbena (*Lantana camara*) dominated the upper stratum. In the absence of cattle grazing, secondary succession in this area would probably produce a pineland community.

Old-Field Associations. Recently abandoned agricultural land occupied approximately 12 percent of the Big Bend site. Most old fields were bordered by wind breaks of Australian pine (*Casuarina litorea*) that approach 40 feet in height. A number of factors contribute to the many variations in the old-field communities that become established after abandonment: the degree of disturbance, the time elapsed since disturbance, the soil type, the distance from saltwater, and the distance and alignment of remaining shrubs and trees.

Areas 1, 3, 3A, and 12 (Figure 3-7) were representative of early seres on the site; portions of the former two areas were disturbed by construction activities. Areas 1 and 12 were essentially ruderal communities that contained 34 and 43 species of plants, respectively, with very few woody elements. Dominant species in Area 1 included sesban (*Sesbania exaltata*), finger grass (*Chloris petraea*), cow pea (*Vigna luteola*), dog fennel (*Eupatorium compositifolium*), and crabgrass. Important species in Area 12 included dog fennel, ragweed (*Ambrosia artemisiifolia*), dwarf horsetail (*Conyza canadensis*), tickseed (*Bidens pilosa*), crabgrass, indigo brush (*Indigofera hirsuta*), and frog bit (*Lippia nodiflora*). Although Areas 3 and 3A were essentially ruderal communities, they were successionally more advanced. Goldenrod (*Solidago* sempervirens var. mexicana and S. microcephala) and nut grass (Cyperus rotundus) were dominant.

Pine Flatwoods. Collectively, Areas 5 and 8 accounted for about 4 percent of the site and were two of the less disturbed communities. These areas demonstrated later stages of pineland succession after disturbance, presumably by fire, selective cutting, and perhaps cultivation; however, during the latter part of the field surveys, a fire destroyed the vegetation of these areas.

Before the fire, the upper stratum in Area 8 was dominated by cabbage palm, saw palmetto, wax myrtle, and saltbush. Mature individuals of slash pine were also present. Important species in the lower stratum included goldenrod, milk pea (Galactia elliottii) and sweet broom (Scoparia dulcis). Garren (1943) concluded that fire is the main factor responsible for the perpetuation of the species of the pine flatwoods. Both the longleaf and slash pine flatwoods will give way to hardwoods when fire is eliminated.

Mangrove Swamp. A mangrove community (Area 6) occupied about 12 percent of the Big Bend site and formed a distinct vegetational zone along the southwestern coastal portion of the site where tidal flushing occurred. This was the oldest and least disturbed community on the site. The area contained essentially only three arborescent species: white, red, and black mangrove. Mangroves are essential to the stabilization of coastal areas and fulfill several other significant ecological roles (Snedaker, 1978).

Salt Prairie. Area 7 occupied approximately 3 percent of the site and was dominated by halophytic plant species, including sea daisies (Borrichia frutescens), shore grass (Monanthocloe littoralis), and salt grass. This area was transitional between the mangrove swamp (Area 6) and the pine flatwoods (Areas 5 and 8).

Freshwater Wetlands. Areas 4 and 10 were small areas of impeded soil drainage classified as freshwater wetlands; each area showed a low index of similarity to all other areas on the site. Area 4 (approximately 4 acres in size) had the highest plant diversity of any area studied at Big Bend. The soil was saturated or covered in some areas with surface water. The upper stratum was dominated by low trees and shrubs, including elderberry, Brazilian pepper, wax myrtle, saltbush, and southern willow. Common species in the lower stratum included crownbeard (Verbesina laciniata), tickseed, panic grass (Panicum purpureum), and ragweed. In 1975, Area 10 included a small pasture pond that had a maximum water depth of approximately 3 feet. Common plant species along the pond margin included water arrowhead (Sagittaria graminea), water pennywort, smart weed (Polygonum punctatum), water-hyssop (Bacopa cyclophylla), cattail (Typha latifolia), and black rush (Juncus roemerianus). Surrounding the pond was a low marshy area dominated by cordgrass (Spartina bakeri). In the 1977 survey, most of the open water had disappeared due to encroachment of herbaceous species.

In addition to the areas already discussed, a freshwater drainage canal traversed the southern portion of the site. The eastern end of the drainage canal was headed by a small freshwater marsh. The western portion of the canal merged with a brackish mangrove-Spartina marsh before discharging into

Tampa Bay. The species in this area included both mesic and halophytic plant forms.

Disturbed and Reclaimed Areas. Several portions of the Big Bend site were categorized as disturbed or reclaimed areas. These included dredge-and-fill land, the power-line right-of-way, and roadside areas.

Dredge-and-fill land reclaimed for the construction of the power-plant facilities made up approximately 25 percent of the site. Areas not committed to construction were in early stages of colonization by annual weeds and halophytes. If left undisturbed for many years, the species complex in these areas probably would broaden to resemble old-field succession and later would broaden to resemble shore-hammock succession. However, reclaimed lands are difficult for plants to colonize; the strongly alkaline soil, the high salt content, the absence of organic components, and rapid leaching all combine to restrict plant growth.

The power-line right-of-way (Area 2) was maintained to some extent by periodic mowing. Dominant plant species were essentially ruderal in nature and included Bermuda grass (Cynodon dactylon), tickseed, and ragweed. Roadside areas also contained numerous species of annual and perennial weeds.

In conclusion, floristic habitats found on the Big Bend site were quite disturbed and for the most part were common elsewhere throughout Hillsborough and surrounding counties. The species composition of Areas 1, 2, 3, 3A, and 12 was the most similar. The mangrove-swamp (Area 6) and freshwater-marsh communities (Areas 4 and 10) were ecologically the most unusual and most sensitive areas at the site.

Fauna

The following paragraphs describe the terrestrial fauna that have been reported or could occur at the Big Bend site and in the surrounding area. Those species designated as rare, endangered, or protected are discussed in Section 3.5.

Amphibians and Reptiles. Limited sampling for amphibians and reptiles has been carried out on the site.

The six species of amphibians observed at the site are common regionally in their preferred habitats. Because of the scarcity of permanent fresh water at the Big Bend site, these six species are probably uncommon there. The species do, however, breed in intermittent pools caused by rains; hence, they may use any part of the site where these pools are formed. Two of these species, the bullfrog and the green tree frog, typically occur in aquatic environments throughout the year, and the green tree frog sometimes occurs in saline mangrove swamps or in terrestrial habitats near water. The other four species observed are the southern toad, the eastern narrowmouth toad, the squirrel tree frog, and the southern leopard frog. They may also be found in terrestrial flatwoods communities, but they usually do not occur far from water.

Fifty-nine species of reptiles have been reported in west-central Florida, and 56 of them were recorded in Hillsborough County by Layne et al. (1977).

These include 15 species of turtles (including 3 sea turtles), 1 species of alligator, 11 species of lizards, and 29 species of snakes. Twelve of the 15 turtle species would occur only in aquatic habitats. The gopher tortoise and Florida or gulf coast box turtle are the only terrestrial turtle species. All 11 species of lizards are terrestrial. The dusky pygmy rattlesnake, the eastern coral snake, the eastern diamondback rattlesnake, and the Florida cottonmouth are the poisonous snakes in the region. Nine snake species are entirely terrestrial, and 6 are mostly aquatic. Two exotics, the Mediterranean gecko and the Cuban brown anole are generally restricted to the Tampa area. The indigo snake, the only species of special status in Florida found at the Big Bend site, was recorded only in the *Myrica*-*Baccharis* association.

No amphibians under State or Federal protection have been reported at the site, and because of zoogeographic range limitations, none are expected. Three protected reptile species of special status might occur at the Big Bend site. The eastern indigo snake, which was recorded at the site in the *Myrica*-*Baccharis* association, could also occur in the dry prairie, mangrove swamp, and typical pine flatwoods. The gopher tortoise could occur in the dry prairie or typical flatwoods, but its occurrence at the site is unlikely. The American alligator could occur near the mangrove swamp or possibly in ditches or canals leading into the site from Tampa Bay, but it would not be expected in abundance.

Birds. One hundred and four species of birds were reported at the Big Bend site during surveys conducted in 1972, 1974, 1975, and 1977 (Stone & Webster Engineering Corporation, 1972; Long, 1974a, 1975; Wunderlin and Long, 1975a,b; Wunderlin et al., 1977).

The greatest species diversity, based on combined surveys at Big Bend, was reported along the intermittent beaches (47 species) and in the mangroves (36 species). The least diversity was in the palmetto-*Juncus* association (6 species), salt prairie (7 species), power-line right-of-way (8 species), and cosmopolitan (10 species).

Many species use a variety of habitats (e.g., 12 species were recorded in five or more habitats). The mockingbird and loggerhead shrike were reported in eight habitats; great blue herons and red-winged blackbirds, in seven habitats; ground doves, in six habitats; and cattle egrets, killdeers, mourning doves, blue jays, fish crows, palm warblers, and boat-tailed grackles, in five habitats.

Sixteen special-status species were reported along the intermittent beaches, an area used primarily for resting and feeding. Only the American oystercatcher, the least tern, the royal tern, the Caspian tern, and the black skimmer could breed in this habitat in the region, but none are expected at the Big Bend site. Ten special-status species were found in the *Myrica*-*Baccharis* association, which is also mainly a resting and feeding area. Nine special-status species were found in the mangroves. Several species of herons, egrets, and ibis also could nest there, although no nesting was reported.

The eastern brown pelican is the only species listed as endangered by the Federal Government that has been reported at the Big Bend site. Although it was consistently reported during all survey periods, it is unlikely that it nests at the site.

The Florida Game and Fresh Water Fish Commission (FGFWFC) lists 14 species of special concern that could occur at the Big Bend site, and 8 of them were reported. The only one that the FGFWFC lists as an endangered species is the wood stork. The species listed by the FGFWFC as threatened and found at the site are the brown pelican, the American kestrel, the sandhill crane, and the least tern. The American oystercatcher, the reddish egret, and the roseate spoonbill are listed as species of special concern. Not one of these FGFWFC species was reported to nest at the site. If any of these species breed on the Big Bend site, nesting would probably occur in the mangroves or along the intermittent beaches.

The Florida Committee on Rare and Endangered Plants and Animals (FCREPA, 1976) lists 42 special-status species in the region, and 21 of them were reported at the site (Kale, 1978). Twelve species not included on the Federal or State lists were found on the Big Bend site and are considered species of special concern by the FCREPA. These include 3 heron species, 2 egret species, 1 bittern species, 2 ibis species, 2 tern species, 1 skimmer species, and 1 warbler species. None have been reported to nest at the site.

Mammals. Of the 45 species of terrestrial mammals whose geographic ranges include Big Bend, 19 were identified at the site during surveys carried out between 1972 and 1977 (Stone & Webster Engineering Corporation, 1972; Long, 1974a,b,c, 1975; Wunderlin and Long, 1975a,b; Wunderlin et al., 1977).

The hispid cotton rat is the most widespread and abundant small mammal at the site. It was reported in every habitat sampled. The marsh rice rat and the house mouse were also relatively common. The northern yellow bat is probably the most common bat in the region and at the site. The raccoon, the Virginia opossum, and the cottontail are the most common large mammals at the site, and they are found in a variety of habitats. No large game mammals (e.g., white-tailed deer and wild boar) are believed to occur at the site. The mountain lion (Florida panther) is the only regional terrestrial mammal on the Federal list of endangered species. It has not been authoritatively reported in the County, but there have been several unconfirmed reports. It is not expected at the site. Two other species (i.e., bobcat and river otter) are under review by the Federal Government for special-status listing, but neither has been observed nor is expected to occur at the Big Bend site because of habitat restrictions.

No terrestrial mammalian species of special status, as listed by the FGFWFC, is expected at the Big Bend site.

Nine special-status terrestrial species are listed by the FCREPA (Layne, 1978). Only the big brown bat (rare), Rafinesque's big-eared bat (rare), and the long-tailed weasel (rare) would have any chance of occurring at Big Bend. None have been reported at the site. All three species are considered rare in the region.

3.2.2 IMPACTS OF CONSTRUCTION ACTIVITIES

The primary impacts associated with the construction of Unit 4 will include the commitment of approximately 41 acres of land for parking, equipment laydown, construction workshops, temporary storage of excavated material, and the erection of buildings that comprise and are associated with Unit 4. Unit 4 plant structures will require approximately 7 acres of land. An additional 7 acres will be designated for the coal reserve and service facilities associated with Unit 4. A railroad spur will also be constructed at the site. Much of the area that will be temporarily committed to laydown, parking, and excavated-material storage during construction will be restored during or after the completion of construction.

All of the acreage slated for construction activities has been previously disturbed during the construction of Units 1, 2, and 3. This area contains primarily herbaceous, low-growing vegetation typical of disturbed areas in the early stages of secondary succession. These species rapidly become established on disturbed lands and are commonly found within the region; therefore, the clearing of this disturbed area will not have a lasting adverse ecological impact.

Clearing and construction activities will result in the displacement or elimination of all sedentary fauna (primarily small mammals) that may presently inhabit this area. This is not considered an important long-term ecological impact since these species most likely exist in more stable populations in nearby, less disturbed areas. More mobile fauna, such as birds and large mammals, which may occasionally enter this area, will tend to avoid it during the construction period. Since the area does not represent an important habitat for locally occurring fauna, its use for construction activities does not constitute an important loss of wildlife habitat.

In addition to the 41 acres previously described, approximately 97 acres will be preempted by the sites for the storage and disposal of flue-gas desulfurization (FGD) byproduct gypsum. These 97 acres consist of approximately 66 acres of pastureland (including a small pond less than an acre in size and an associated marsh) and 31 acres of agricultural land.

The pastureland consists primarily of ruderal or weedy species of herbaceous vegetation. At the time of the ecological surveys conducted in 1977, this land was no longer being used as a cattle-grazing area. The 1974-1975 surveys showed that the pasture and pond/marsh areas supported a relatively small number of vertebrate species by comparison with less disturbed habitats at the Big Bend site. The species inhabiting the pasture included the hispid cotton rat, the marsh rice rat, the eastern cottontail, the marsh rabbit, and certain field- and marsh-dwelling birds. The 1977 survey indicated that most of the pasture pond had disappeared and vegetation was more typically old field (i.e., drier) than marshland. There was also an increase in vertebrate species preferring old-field habitats and a sharp decrease in the number of marshland species; marsh birds were notably absent from the area. The 31 acres of agricultural land represent supplemental sources of food and cover for wildlife, but their availability depends on the types of crops planted and the frequency of tillage.

The development of the proposed gypsum storage and disposal area represents a long-term commitment of these pasture and agricultural lands. However, the preemption of these plant communities and wildlife habitats is more ecologically acceptable than that of other available parcels at the Big Bend site for two reasons: (1) these habitats have been recently disturbed and are not unique to the Big Bend site or the surrounding areas; and (2) they are among the least biologically important wildlife habitats at the site.

The ash-disposal ponds for Unit 4 will require 121 acres of land. The bottom-ash pond will be located in the area currently occupied by an unused U-shaped cooling pond. The fly-ash pond will be located adjacent to the bottom-ash pond on land classified as "old field." The impacts of the preemption of this area will be similar to those described in the previous paragraphs.

The only construction associated with the transmission lines for Unit 4 will be the installation of an additional 230-kilovolt circuit on the existing towers. There will be no need for a new right-of-way. Land areas beneath the transmission line (1) are zoned for industrial purposes, (2) do not include critical wildlife habitats, and (3) do not require the presence of man-made structures or alterations of terrain. Vegetation may be disturbed temporarily by vehicles carrying equipment, but since this will not affect any mature forest or important flora, irreversible impacts are not expected. Erosion problems also are not expected; however, should any problems develop, mitigation will be effected by the use of mulch, temporary or permanent vegetation, or erosion-control fabrics.

Dredge spoils resulting from Unit 4 construction and maintenance activities will be disposed of at either or both of the dredge-disposal areas shown on Figure 3-8. These are existing disposal areas that have been used for Units 1-3. The northeast disposal area consists of three cells and occupies approximately 22 acres. The large cell is enclosed by earthen dikes that rise 20 feet above grade. The two smaller cells are diked to an elevation of 15 feet. The south disposal area is enclosed by a 20-foot dike and covers approximately 45 acres.

Dredging associated with the construction and installation of the Unit 4 cooling-water intake and discharge structures involves only a small amount of spoil material. This will be removed by clamshell and trucked to the disposal areas. No discharge from the disposal areas is expected.

The conceptual location for a mechanical-draft cooling tower is directly south of the Unit 4 plant structure on the south bank of the discharge canal and just west of the bottom-ash pond and Beach Road (Figure 3-8). The tower would be located so as to minimize impact on the nearby mangrove area.

The noise produced by construction equipment and related activities could have an impact on wildlife in the vicinity of the Big Bend power plant. The assessment of the impact of construction noise on wildlife is based largely on the investigation of Fletcher and Busnell (1978). A summary of this state-of-the-art symposium included the observation that "There is not overwhelming evidence that noise is not a significant adverse factor in the life of animals. But neither is there clear definitive data demonstrating that noise is an adverse stimulus or stressor (to animals)."

Responses of vertebrate fauna to construction noise may vary from species to species and will depend on distance from the power plant and from other intrusive-noise sources. Species nearest the plant may undergo periodic "startle reactions" and move away from the noise source (if possible) when peak-construction sound levels occur; however, most of the species nearest the plant are expected to have adjusted to the existing noise from the operation of Units 1, 2, and 3. Many of these species (e.g., raccoons, mice, rats, rabbits, and several bird species) coexist with man and typify habituation to human activities and the accompanying noise (Fletcher and Busnell, 1978).

Fauna inhabiting areas other than the gypsum storage and disposal area should experience little, if any, increase in noise levels during construction. For this reason, no measurable effects of construction noise on species occurring near or beyond these locations are expected.

Site restoration will begin during the latter stages of construction or after its completion. Certain areas will be surfaced with crushed stone to maintain areas frequently used by maintenance personnel and heavy equipment. Trees, shrubs, and ground cover will also be planted during site restoration. The vegetation will be selected to satisfy three primary objectives: (1) the stabilization of soils, (2) the creation of an aesthetically appealing physical plant and surrounding area, and (3) the establishment of wildlife habitats and food sources. The plant species that have been tentatively selected include those native to the Big Bend site and those that will ecologically and aesthetically complement naturally occurring species. Whenever practical, trees and shrubs will be transplanted from within the Applicant's property to areas undergoing site restoration.

An increase in the use of heavy equipment and the storage of building supplies at the site may result in erosion, soil compaction, and alteration of surficial soil characteristics. However, the dredge-and-fill soils, which are predominant at the site, will show few signs of construction impact in addition to those of earlier construction activities. The adverse effects of compaction and surficial soil alteration on cultivated lands and pasturelands that are used only temporarily can be reversed during revegetation.

3.2.3 IMPACTS OF OPERATION

The following discussion of the terrestrial impacts of the operation of Big Bend Unit 4 focuses on the impacts of coal handling and of both sulfur dioxide and particulate emission control.

3.2.3.1 Impacts of Coal-Handling

Because the coal will be received, stored, and handled in the same manner and with the same facilities as are now used for Units 1, 2, and 3, no adverse impacts on the terrestrial ecosystem are expected. Impacts due to dust and noise may occur, but these will be minor and will not affect important wildlife or their habitats. Runoff from the coal-storage pile will be controlled by retention trenches, and contamination of adjacent soils is not expected.

3.2.3.2 Impacts of Sulfur Dioxide Control

The primary impact on terrestrial systems from the operation of the sulfur dioxide-control system will be the preemption of approximately 97 acres of land for the gypsum storage and disposal area. Probable effects on resident flora and fauna in the site area are discussed in Section 3.2.2. Depending on the marketability of the gypsum, onsite storage and disposal will either temporarily or permanently remove the area from further use for the lifetime of the plant.

The disposal plan calls for the staged development of four separate storage and disposal areas. A new area will be developed as needed when the area in service nears its storage capacity. Such an arrangement provides for both short- and long-term storage, and for permanent disposal if necessary. If the gypsum cannot be sold, the use of small disposal areas allows for better control of rainfall runoff and housekeeping procedures.

Soils at this site belong to the Sunniland-Bradenton association. They are poorly drained soils with thin, sandy layers over loamy subsoil underlain by marly material (Florida Department of Administration, 1975; Stone & Webster Engineering Corporation, 1973). Permeabilities range from 0.05 to 0.0001 centimeter per second for the first 15 feet of soils.

The gypsum will be transported to the proposed site by means of a conveyor system and will be handled by bulldozer. At this stage, it should contain approximately 10 percent water; therefore, it should not undergo wind erosion or create a fugitive-dust problem during transport.

If permanent disposal is necessary, the material will be landfilled in a heaped fill configuration as shown in Figure 2-15. This technique was found to be most adequate in view of the site's geologic and topographic characteristics. Experience with this type of landfill has shown that problems arising in the areas of groundwater pollution, slope stability, and site preparation are minimal in comparison with other disposal methods. Fugitive-dust problems are not expected, since the gypsum, when left undisturbed, forms a protective crust that minimizes wind erosion and dusting tendencies (Coltharp et al., 1979).

One disadvantage of this type of fill is its visibility; it tends to contrast markedly with surrounding flat terrain. To mitigate the aesthetic impact, the site will be screened from areas of public access with vegetation. Vegetative screening has been employed at the Big Bend site with excellent results. In addition, once a disposal phase is completed, topsoil and fertilizer will be applied before revegetation begins. Ground-cover species commonly used in the area, such as Papsalum notatum (Bahia grass), and Lespedeza repens (creeping lespedeza), will be used to complement naturally occurring species.

The parcels of land to be used for gypsum storage and disposal will be placed so as to minimize the disruption of existing drainage patterns. Newman Branch and adjacent wetlands will be protected from any potential runoff by the design and placement of dikes around the disposal sites. Any modification to the existing drainage patterns will continue to direct nongypsum-pile runoff into these wetlands. The main objectives in the design and construction of drainage modifications will be to minimize erosion and to maintain the existing water quality.

3.2.3.3 Impacts of Particulate Control

The primary impact on terrestrial systems from the operation of the particulate control system will be the preemption of 121 acres for the settling ponds and disposal cells for bottom ash, unmarketable fly ash, pyrites removed from the coal before combustion, and economizer ash. The bottom-ash-disposal site will be located in the area currently occupied by an unused cooling pond. The fly-ash-disposal site will be adjacent to the bottom-ash pond on land that is classified as "old field."

Other potential terrestrial impacts from the control of particulates include (1) the use of active disposal ponds by waterfowl and (2) the effects of runoff and seepage from disposal sites (Dvorak et al., 1978).

The presence of a large body of standing water can sometimes be attractive to waterfowl as a resting and feeding area, particularly if there are sources of food nearby. Ash-settling ponds are examples of such bodies of water. Waterfowl using these ponds are thus exposed to potentially harmful particulates and chemicals dissolved in the water.

During the operation of a power plant, runoff from the onsite waste impoundment is unlikely if the dikes confining the ash are properly constructed. Vertical and lateral seepage from unlined ash-disposal sites can occur, particularly where the waste material is deposited as a slurry. The major impact of seepage is the addition of potentially toxic elements and ions to soils, ground water, and surface waters. In addition, seepage introduces radionuclides and other potentially harmful elements into the growth medium of local vegetation.

The bottom-ash settling ponds for Big Bend Unit 4 will be unlined and designed to store approximately 6 months of ash production. As these ponds are filled, the ash will be hydraulically dredged to final disposal cells. It is expected that the disposal cells will reach a maximum height of 35 feet.

The settling ponds and disposal cells for unmarketable fly ash, pyrites, and economizer ash will be lined and enclosed by earthen dikes. Liner material will have a low permeability (0.0000001 centimeter per second).

3.2.4 IMPACTS OF COOLING TOWERS

The impacts on terrestrial systems of the operation of a mechanical-draft cooling tower are considered in the following sections. Included for separate consideration are saltwater, brackish-water, and freshwater towers.

3.2.4.1 Saltwater Towers

The primary impact on terrestrial systems from the operation of mechanical-draft cooling towers using saltwater makeup will be salt deposition due to drift. The drift predictions for the mechanical-draft tower are given in Table 3-17 and Figure 3-9, which show annual average deposition rates within approximately 1-mile of the tower (Stone & Webster Engineering Corporation, 1979).

The data suggest that there are two areas near Big Bend Station of primary importance in evaluating the potential terrestrial impacts of cooling-tower salt emissions. One area consists of the palmetto-*Juncus* and palmetto-pine associations in the area adjacent to and south of the proposed cooling-tower location. The drift predictions indicate that this vegetation will receive the heaviest onsite terrestrial application of salts, regardless of the tower design alternative. Unfortunately, there are insufficient pertinent data on salt tolerance for the plant species occurring in this area, and, therefore, the extent of injury and the species involved cannot be precisely determined. However, based on the predicted salt levels and on the reported susceptibility of vegetation to salt damage, it would appear likely that much of the vegetation in the palmetto-pine and palmetto-*Juncus* associations would be severely injured as a result of foliar salinization. The permeability of the soils combined with the high annual rainfall (approximately 50 inches per year) should reduce the potential for an excessive accumulation of salts and thus for the adverse consequences of soil salinization in these associations.

The other area of primary importance lies to the east and southeast of the cooling tower. Within this area, crops such as tomatoes, red peppers, sweet onions, and strawberries are grown commercially. Of these crops, tomatoes are moderately salt-sensitive and peppers, onions, and strawberries are very salt-sensitive (Hayward and Bernstein, 1958; Nieman, 1962; Bernstein, 1964). Higher salt levels than currently exist are also expected in those areas where the vegetation consists primarily of old-field herbaceous and shrub species and salt-tolerant species like mangroves and salt-marsh grasses. The occurrence and salt tolerance of ornamentals in offsite residential areas are presently unknown.

Table 3-19 shows the maximum monthly salt-deposition rates predicted in areas where agricultural crops are currently cultivated. Within the agricultural areas 3000-6000 feet to the east and southeast of the cooling tower, these predicted maximum monthly rates range from 1.5 to 8.8 pounds per acre. With one exception, these are sufficiently below the damage criterion of 8.9 pounds per acre per month cited by Curtis et al. (1977). However, because a portion of one agricultural area receives up to 8.8 pounds per acre for the month of June, there is the possibility of some crop damage in a portion of this area. Moreover, the predicted salt deposition of more than 20 pounds per acre in these agricultural areas exceeds the criterion (17.8 pounds per acre per year) used by the Nuclear Regulatory Commission staff. However, the potential for damage (either through foliar or soil salinization) is low because of the frequency and the amount of rainfall in the area.

In a 1980 study, an attempt was made to simulate the effects of salt-drift deposition on the local, commercially important tomato crop (Stone & Webster Engineering Corporation, 1980). Concurrent with this study, a program was conducted to monitor ambient salt-deposition rates at four sites in the vicinity of Big Bend. On the average, ambient salt deposition was greatest at the station closest to Tampa Bay. The highest daily deposition measured in the study was 0.198 kilogram per hectare. Based on this value, ambient salt deposition for a 1-month period would total 5.94 kilograms per hectare.

The salt-drift model predicts that salt deposition resulting from the operation of a mechanical-draft cooling tower would amount to 9.85 kilograms per hectare per month in the agricultural area where the simulation study was conducted. The maximum total salt deposition expected from natural and cooling-tower sources (approximately 15.8 kilograms per hectare per month) falls within the range of deposition (1.1 to 44.8 kilograms per hectare per month) tested in the drift-simulation study.

Although analyses indicated that the chloride content of the leaves of tomato plants receiving experimental salt spray was significantly higher than that of untreated controls, no visible symptoms of foliar injury were observed. Moreover, there were no apparent deleterious effects of saline spray on tomato quality at the levels tested. It should be noted that these are results of a preliminary study only.

Only general conclusions can be drawn from existing literature on the effects of salt on vegetation in the area of Big Bend Station, since most of the literature is based on testing in the Northeastern United States and involves plant species not found in the area of Big Bend. However, based on the two general criteria mentioned above, it appears that some significant salt damage could occur in some areas in the vicinity of the towers. Preliminary evidence indicates that damage to tomato crops will be minimal.

The synergistic effects of cooling tower drift and stack emissions (e.g., sulfur dioxide, nitrogen oxides, and particulates) represents another potential source of damage to vegetation near Big Bend Station. There is presently no evidence to suggest that existing stack emissions alone are causing stress to vegetation in the vicinity of the power station; however, it has been reported that increased humidity (such as would result from cooling-tower or wet-scrubber operation) enhances the potential for vegetation injury through the formation of corrosive liquids (e.g., sulfuric acid) on plant surfaces (Dvorak et al., 1978). It is also known that plant tissues that have been damaged by various agents (e.g., insects, mechanical breakage, and chemicals such as sulfuric acid) are more susceptible to salt injury than undamaged, vigorous plant tissues (Roffman et al., 1973). Therefore, it is possible for stack emissions to intensify the harmful effects of salt drift on vegetation. However, the scarcity of relevant biological information prevents a full determination of the consequences for plant life of the interaction between cooling-tower drift and stack emissions.

3.2.4.2 Brackish-Water Towers

The impacts of this alternative would presumably be similar to those described for the saltwater cooling tower. However, drift effects should be less severe because of differences in the makeup water. The reduced content of dissolved solids in the water would allow for a higher concentration factor (ratio of solids in the circulating water to solids in the makeup water) and higher drift rates. Alternatively, with equivalent drift rates, the salt deposition would be less than with saltwater makeup.

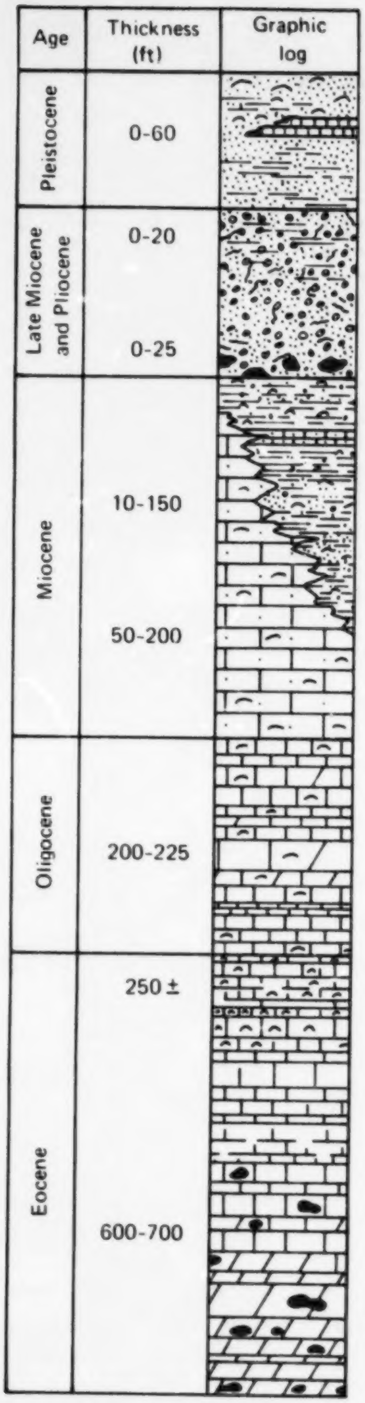
3.2.4.3 Freshwater Towers

The impacts of this alternative should be similar to those described for the other types of cooling towers. However, drift effects should be minimized, through the use of fresh water as makeup, the precise impacts depending on the concentration of dissolved solids in the drift.

Table 3-19. Maximum monthly salt-deposition rates in nearby agricultural areas attributable to cooling-tower operation[a]

Agricultural area	Distance (ft)	Direction	Month	Monthly deposition (lb/acre)
1	3000-4250	E	July	4.6-2.5
2	4250-5500	E	July	2.5-1.5
3	4000-6000	SE	June	8.8-4.2
4	3000-4250	E	July	4.6-2.5
5	4250-5500	E	July	2.5-1.5

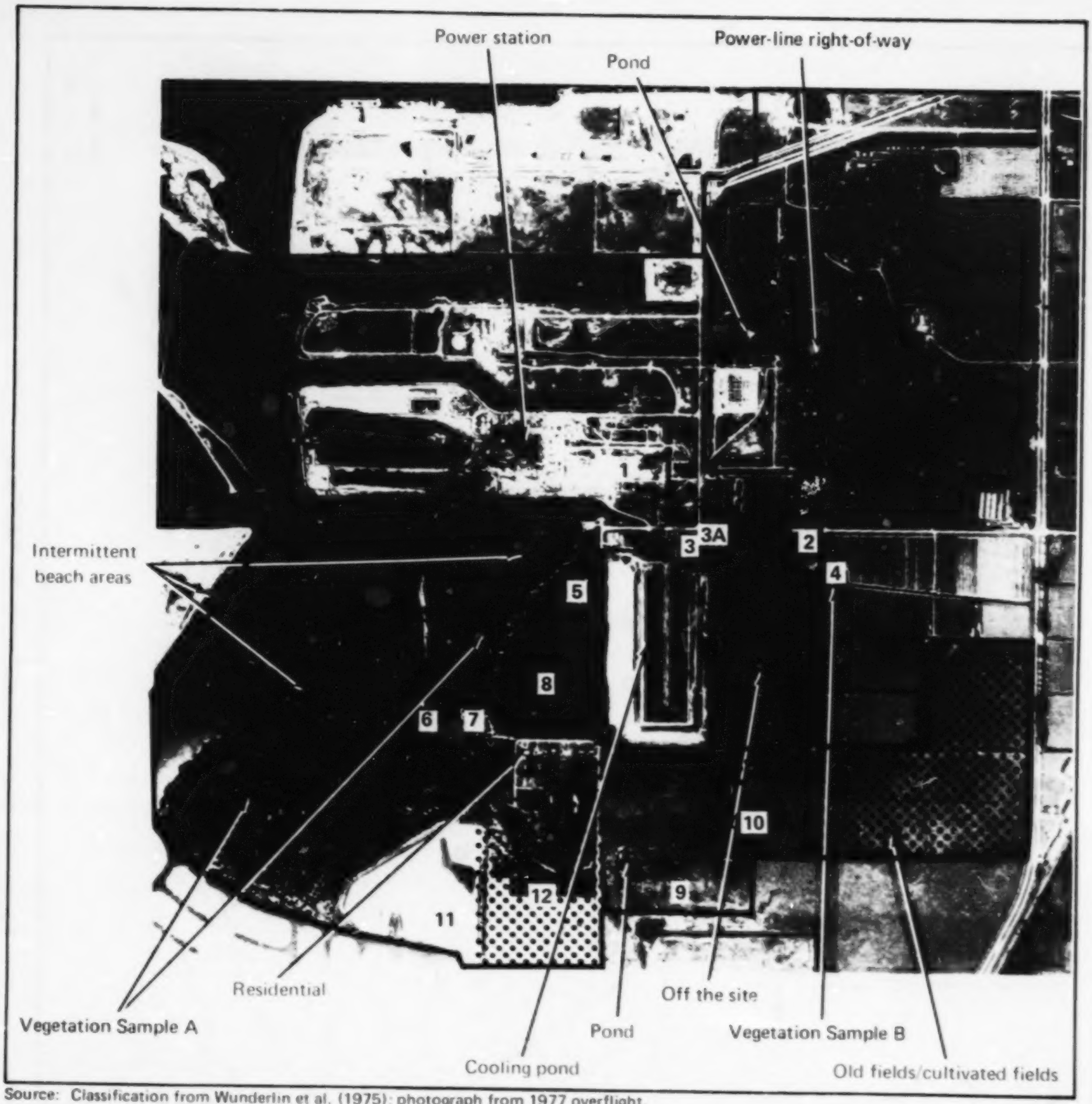
[a] Adapted from Stone & Webster Engineering Corporation (1979).


Age
Thickness (ft)
Graphic log
Pleistocene
0-60
Late Miocene and Pliocene
0-20
0-25
Miocene
10-150
50-200
Oligocene
200-225
Eocene
250 ±
600-700

Stratum	Description
Pamlico Sand	Sand, shells, limestone, calcareous clay
Older terrace deposits	Sand, silt, some clay
Undifferentiated deposits	Sand, quartz, and phosphate gravel; upper–bone fragments; lower–lignite
Hawthorn Formation	Green/gray, blue/gray, sandy, phosphatic clay and marl, sandy limestone, sand, silt, and shell interbeds
Tampa Formation	White to gray and tan, fairly hard, porous to dense, sandy, fossiliferous limestone, occasionally silicified
Suwannee Limestone	White to tan, moderately soft, granular, porous, fossiliferous limestone, occasionally dolomitic and crystalline
Ocala Group	White, cream, and tan, soft, granular, chalky, fossiliferous limestone, occasionally coquinoid
Avon Park Limestone	Upper–white to tan, soft, slightly chalky, granular, foraminiferal limestone; lower–tan to dark brown, hard, very porous, crystalline dolomite, occasionally lignitic

Source: TECO (1979).

Figure 3-6. Generalized stratigraphic section, Big Bend site.

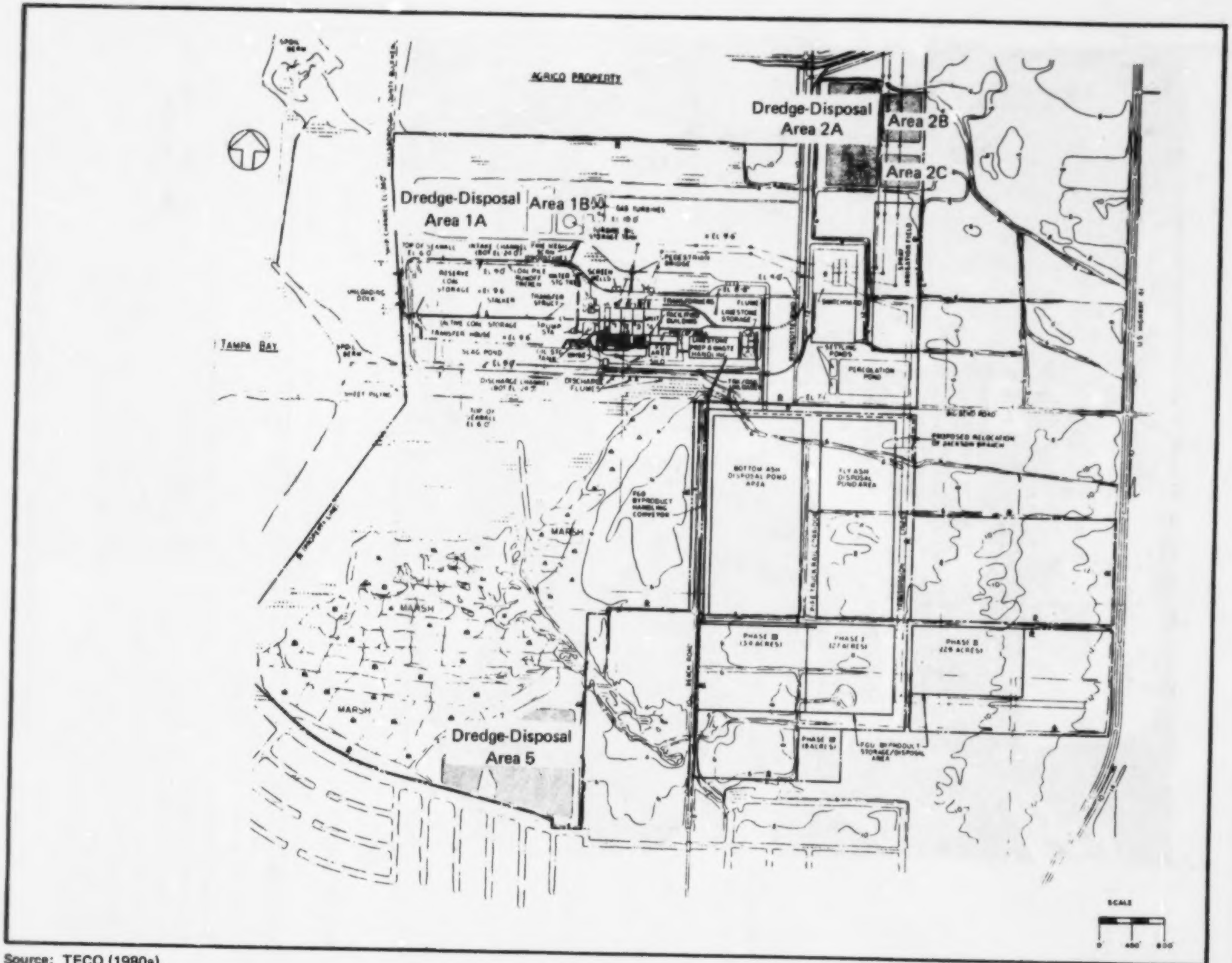

Power station
Pond
Power-line right-of-way
1
3
3A
2
4
5
8
6
7
10
9
12
11
Intermittent beach areas
Residential
Vegetation Sample A
Cooling pond
Pond
Off the site
Vegetation Sample B
Old fields/cultivated fields

Source: Classification from Wunderlin et al. (1975); photograph from 1977 overflight.
Power station boundaries of Tampa Electric Company, 1973.
"Big Bend Lands" engineering line drawing dated November 8, 1973.

1	Ruderal community
2	Power-line right-of-way
3	Successionally advanced ruderal community
3A	Successionally advanced ruderal community
4	Freshwater wetlands
5	Pine flatwoods
6	Mangrove community
7	Mangrove-pine flatwoods transition area
8	Pine flatwoods
9	Pasture
10	Pasture pond
11	Artificial barren land
12	Ruderal community

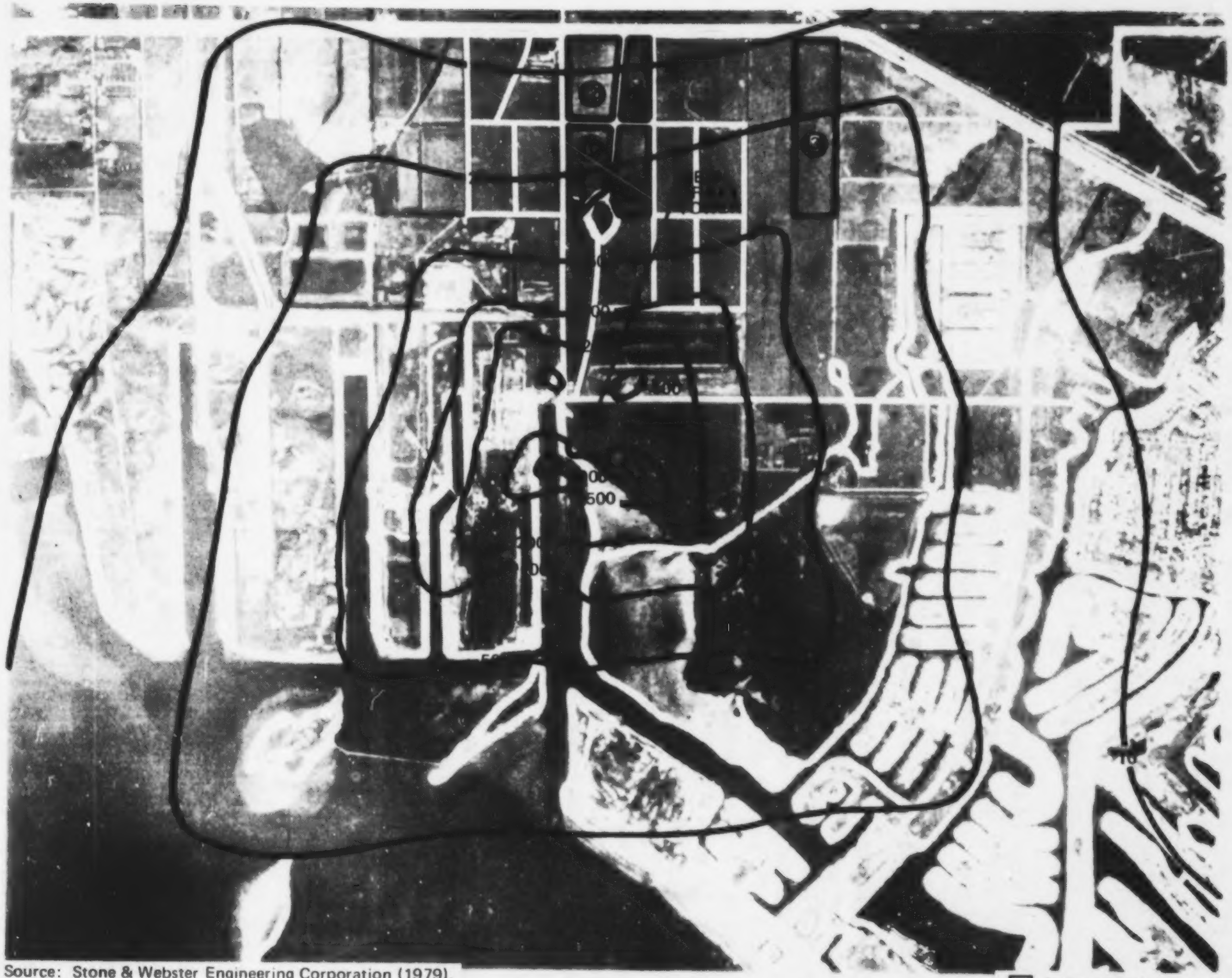
0 500 1000 Feet

Figure 3-7. Vegetation cover types at Big Bend Station.


AGRICO PROPERTY
Dredge-Disposal Area 2A
Area 2B
Area 2C
Dredge-Disposal Area 1A
Area 1B
TAMPA BAY
SPOIL BERM
UNLOADING DOCK
TOP OF SEAWALL EL 6.0
INTAKE CHANNEL (BOT EL 24.0)
RESERVE COAL STORAGE
EL 9.6
STACKER
TRANSFER STRUCT
IN TIME COAL STORAGE
TRANSFER HOUSE
SLAG POND
SCREEN WELLS
GAS TURBINES
PEDESTRIAN BRIDGE
TRANSFORMERS
FLUME
LIMESTONE STORAGE
LIMESTONE PREP & WASTE HANDLING
SILO
DISCHARGE CHANNEL (BOT EL 24.0)
DISCHARGE FLUMES
SHEET PILING
SETTLING PONDS
PERCOLATION POND
SWITCHYARD
SPRAY IRRIGATION FIELD
EL 7.4
BIG BEND ROAD
PROPOSED RELOCATION OF JACKSON BRANCH
BOTTOM ASH DISPOSAL POND AREA
FLY ASH DISPOSAL POND AREA
FGD BYPRODUCT HANDLING CONVEYOR
MARSH
PHASE III (34 ACRES)
PHASE I (27 ACRES)
PHASE II (28 ACRES)
PHASE III (8 ACRES)
FGD BYPRODUCT STORAGE/DISPOSAL AREA
BEACH ROAD
US HIGHWAY 41
Dredge-Disposal Area 5
SCALE
0
400
800

Source: TECO (1980a).

Figure 3-8. Dredge-disposal areas, Big Bend site.



Source: Stone & Webster Engineering Corporation (1979).

▣ Active agricultural area

Figure 3-9. Annual salt-deposition rates (lb/acre) for a mechanical-draft cooling tower at Big Bend Station.

3.3 WATER

The effects of Big Bend Unit 4 on the water resources and aquatic environment in the region of the site are considered below. A description of baseline conditions at Big Bend is followed by a consideration of the impacts of the construction and operation of Unit 4 and of the principal cooling tower alternatives.

3.3.1 BASELINE CONDITIONS AT BIG BEND

The aquatic baseline conditions in the site area are discussed in the following sections. Included for separate consideration are surface water hydrology, ground-water hydrology, water quality, and aquatic ecology.

3.3.1.1 Surface Water Hydrology

Big Bend Station is near the mouth of Hillsborough Bay, a northeasterly extension of the Tampa Bay system (Figure 3-10). The main components of this estuarine system are Tampa Bay, Old Tampa Bay, Hillsborough Bay, McKay Bay, Boca Ciega Bay, and Terra Ceia Bay, which together have a surface area of about 350 square miles and a total shoreline of about 210 miles (Olson and Morrill, 1955; Goodell and Gorsline, 1961). The Tampa Bay system extends about 35 miles north to south and has a maximum width of about 21 miles east to west. The mean water depth is 11 feet, and 90 percent of the estuary is less than 22 feet deep (TECO, 1977). The drainage area of the Tampa Bay system is estimated to be 2235 square miles. The flow of fresh water into this system is predominantly from the Hillsborough, Alafia, Palm, Little Manatee, and Manatee Rivers. The mean annual discharge from these rivers and lesser sources is about 1550 cubic feet per second (U.S. Army Corps of Engineers, 1974).

Hillsborough Bay is approximately 8 miles long and 4 miles wide and has a surface area of about 35 square miles (Goodwin, 1977). The average water depth is 10 feet. Shipping channels have been maintained in the bay at 34-foot depths and are presently being deepened to 40 feet as part of the Tampa Harbor Deepening Project (U.S. Army Corps of Engineers, 1974). Shoreline slopes are gentle. The 6-foot water depth contour is located about 1200 feet off the western shore and 3600 feet off the eastern shore (TECO, 1977).

Tides in the Tampa Bay system are predominantly diurnal with a strong semidiurnal component (i.e., two high tides and two low tides per day). The diurnal tide ranges from 2 to 2.8 feet, with Hillsborough Bay having a range of approximately 2.8 feet (Ross, 1973). The average water level in Tampa Bay is 0.5 foot above mean sea level (U.S. Army Corps of Engineers, 1974). The average water level in Hillsborough Bay is 1.4 feet above mean sea level (TECO, 1977).

Tidal currents in Hillsborough Bay are generally weak and variable; the velocity is seldom greater than 1 foot per second (Goodwin, 1977). A mathematical model of water movement in the bay indicates that several circular currents might be induced by the presence of spoil piles created from dredged materials (Ross, 1973).

The high- and low-tide volumes of Hillsborough Bay are 350,000 and 269,000 acre-feet, respectively (TECO, 1977), with an average tidal flow of 90,000 cubic feet per second at the mouth of Hillsborough Bay. The circulation in Tampa Bay results in minimal flushing of Hillsborough Bay (Goodwin, 1977).

The freshwater discharge into Hillsborough Bay is about 1120 cubic feet per second (U.S. Army Corps of Engineers, 1974). The main surface drainage basins in Hillsborough County are the Hillsborough, Alafia, and Little Manatee River systems. These three rivers have an average combined flow of about 790 cubic feet per second and drain about 70 percent of the county. Two other streams, Bullfrog Creek and Palm River, discharge directly into Hillsborough Bay. Bullfrog Creek drains 40 square miles of land in southern Hillsborough County and enters Hillsborough Bay about 2 miles north of Big Bend. The average flow is about 28 cubic feet per second at a point where the drainage area is 29 square miles. More than 20 percent of the time the flow is less than 1 cubic foot per second. The estimated average flow at the mouth of Bullfrog Creek is about 46 cubic feet per second (Menke et al., 1961).

Three intermittent streams pass through the site: Sims, Jackson, and Newman Branches. These ditches carry water only during and immediately after heavy rainfall.

3.3.1.2 Ground-Water Hydrology

In Hillsborough County, ground water occurs in a series of unconfined, semiconfined, and confined aquifers composed of undifferentiated surface sands and clays. The water table generally yields about 5 gallons per minute in wells 20 feet deep. A major source of this water is local rainfall, with an estimated 700 cubic feet per second of precipitation infiltrating into the aquifer.

Underlying the water-table aquifer is the shallow artesian aquifer in the sand and limestone beds of the Hawthorn Formation. These beds are approximately 65 feet thick at the Big Bend site. Wells in this aquifer yield up to 500 gallons per minute of water of relatively poor quality. The aquifer is recharged by upward leakage from the Floridan aquifer.

The ground-water body under the site has average water-table elevations ranging from 5.5 to 4.0 feet above mean sea level during nondrought periods (Stone & Webster Engineering Corporation, 1973). Available literature suggests that the water table drops considerably during periods of severe drought. There is also evidence of contamination of the water table by inflows of saltwater. The permeability of the first 15 feet of soils ranges from 0.01 to 0.0001 centimeter per second. During a 1973 geotechnical investigation (Stone & Webster Engineering Corporation, 1973), the water table along the northern edge of the proposed gypsum storage/disposal area was monitored by means of four shallow wells. The data collected revealed a hydraulic gradient on the order of 0.006 foot per foot, which indicates ground-water flow from east to west. The transmissivity of the surficial aquifer was estimated to be 1060 gallons per day per foot with a flow rate on the order of 0.6 gallon per day per foot of aquifer width.

3.3.1.3 Water Quality

Surface Water

Hillsborough Bay is bounded on the west, north, and northeast by the City of Tampa. Numerous heavy-industrial facilities and port terminals are located along the north and northeast shores of the bay. Hillsborough Bay waters are generally regarded as the most polluted of the Tampa Bay system. The pollution is attributable to the discharge from sewage-treatment plants, numerous industrial pollutants, and large amounts of nutrients (introduced naturally from rivers and artificially from various phosphate-related activities). In addition, the region is one of low salinities and high turbidities.

Water temperatures in the Tampa Bay system range from 10.0 to 32.0°C (Dragovich and Kelly, 1964), with a mean annual temperature of 22.0 to 25.0°C, and a naturally occurring maximum of 36.9°C (Taylor, 1973). Hillsborough Bay has a range of 11.2 to 35.1°C (Taylor, 1973). Water temperature near the Big Bend site has increased since the 1970 startup of Big Bend Unit 1. Following startup of Big Bend Unit 2 in early 1973, data collected during monitoring programs indicated the annual means and ranges of water temperature near the site had increased several degrees over the published averages for Tampa Bay. Water temperature data collected during the meroplankton and benthic studies recently conducted at Big Bend are presented in Tables 3-20 and 3-21.

The annual average salinity for Tampa Bay is 29.5 parts per thousand, with a range of 10-15 parts per thousand at river mouths to 35 parts per thousand near Mullet Key at the entrance to Tampa Bay. Salinity is greatly affected by heavy summer rainfalls and by the magnitude of evaporation. Salinity data collected during the meroplankton and benthic studies recently conducted at Big Bend are presented in Tables 3-20 and 3-22.

Dissolved oxygen in Tampa Bay waters is generally high except in areas with high biological oxygen demand (sites with high organic decomposition). The mean annual dissolved-oxygen concentration in Hillsborough Bay is approximately 6 parts per million, with a range of 1-12 parts per million (Saloman and Taylor, 1972). Dissolved oxygen data collected during the meroplankton and benthic studies recently conducted at Big Bend are presented in Tables 3-20 and 3-23.

The Hillsborough County Environmental Protection Commission (1972) reported that the biological oxygen demand in Hillsborough Bay ranged from 0.8 to 9.3 milligrams per liter, with a mean of 3.1. Values in southern Hillsborough Bay were generally less than 2 milligrams per liter.

Olsen (1953) recorded an average pH of 8.0 in the Tampa Bay system and 7.9 in Hillsborough Bay. Saloman and Taylor (1972) noted very little variation seasonally or geographically in Tampa Bay and reported a Hillsborough Bay mean of 8.0 and a range of 7.2 to 8.6.

Taylor (1973) reported a mean annual turbidity of 9.0 Jackson turbidity units (JTU) in Tampa Bay and 13.0 in Hillsborough Bay, with a range of 1.7 to 74 units. High turbidity in winter and spring was thought to be caused by high winds that suspend fine bottom deposits.

Data collected by the U.S. Geological Survey (Goetz and Goodwin, 1980) on the "typical concentration conditions" for trace metals in the waters of the Tampa Bay system are presented in Figures 3-11 to 3-18. Included are values for the Big Bend site area.

Information on pesticides in Hillsborough Bay water was collected by the U.S. Geological Survey and summarized by Simon (1974). The following concentrations were reported:

Dichlorophenyldichloroethane	0.002 part per million
Dichlorophenyldichloroethylene	0.002 part per million
DDT	none detected
Dieldrin	none detected
Polychlorinated biphenyls	0.0100 part per million

Additional water quality data for Hillsborough Bay are presented in Table 3-24 (see also Table 3-46), and Table 3-25 contains information on the quality of water collected in the Big Bend intake canal.

Water-quality data collected at several locations in Jackson and Newman Branches are presented in Table 3-26.

Ground Water

The water quality of the surficial aquifer at the Big Bend site is given in Table 3-27. The surficial aquifer has relatively high concentrations of chloride, sodium, sulfate, and calcium, indicating that saline water has mixed with water traveling downgradient in the surficial aquifer. The water exceeds EPA standards for chloride, sulfate, manganese, and total dissolved solids, and exceeds the suggested standards for arsenic.

Data on the water quality of the Floridan aquifer in the site area are limited. Characteristics of the aquifer in the general Tampa Bay drainage area are presented in Table 3-28. Table 3-27 lists water-quality data for several parameters based on the concentrations measured from several wells in the site area. The sulfate concentration exceeds EPA-recommended drinking-water limits.

3.3.1.4 Aquatic Ecology

Numerous investigations of the ecology of the Tampa Bay system in the vicinity of Big Bend have been conducted by the Applicant and others on an intermittent basis since 1960.

Phytoplankton

A total of 133 phytoplankton taxa were recorded from the vicinity of the Big Bend power plant during a study conducted in 1976-1977 with 35-micrometer nets (Hughes and Parks, 1977). These taxa included 83 diatoms, 42 dinoflagellates, and 8 other groups. Ten taxa comprised more than 90 percent of total phytoplankton organisms collected with diatoms accounting for the largest portion of these phytoplankton. Greatest diatom densities occurred during the winter months, with lesser peaks in abundance occurring in late summer and fall. It should be noted that only the larger, armored phytoplankton forms were collected in the coarse-mesh nets used in these studies. Unaccounted for were the small, fragile species (i.e., "naked" flagellates), which typically make up the larger percentage of phytoplankton organisms occurring in estuarine systems (Yentsch and Ryther, 1959; Malone, 1971; Valkenberg and Flower, 1974).

Planktonic blue-green algae (primarily *Oscillatoria* sp.) shared dominance with diatoms or dominated phytoplankton numbers from late summer through early fall. This group occurred in relatively low concentrations throughout the remainder of the study period.

Dinoflagellates were most abundant during spring and summer, dominating the phytoplankton catch during April and July. During the remainder of the study period, dinoflagellates occurred in relatively low concentrations.

No red-tide outbreaks were observed during the 1976-1977 studies, but a few instances of this phenomenon were noted during earlier surveys at Big Bend. In January 1971, isolated blooms of the dinoflagellate *Gymnodinium splendens* occurred and continued through February of that year (Conservation Consultants, Inc., 1971). In late July and early August 1971, *Gymnodinium breve* was found in plankton samples, coinciding with a red tide caused by that organism in Tampa Bay (TECO, 1972). The bloom in Tampa Bay caused massive fish kills.

Macrophytes

Several largely qualitative studies of the benthic macrophyte communities in Tampa Bay have included sampling sites in the Hillsborough Bay and Big Bend areas.

During a field survey of benthic macrophyte distribution conducted in Tampa Bay during the fall of 1960, Phillips (1962) found attached benthic plants only in sparse, scattered patches in Hillsborough Bay. In the shallow waters of the Big Bend area, however, shoal grass (*Halodule*) was common and widgeon grass (*Ruppia*) abundant; offshore, within the 1-fathom contour, manatee grass (*Syringodium*) was abundant and *Ruppia* sparse. Phillips (1960) listed 13 species of macroalgae (including two blue-greens) as occurring in Hillsborough Bay.

A survey of benthic algal distribution was conducted during the period 1967-1968 by the Federal Water Pollution Control Administration (1969) as part of an investigation into water-quality problems in Hillsborough Bay. Macroalgal diversity was found to be limited compared to other areas of Tampa Bay that were similar hydrographically but free of some of the pollution affecting Hillsborough Bay. Principal taxa recorded in the study area were *Gracilaria verrucosa*, *G. foliifera*, *Ulva lactuca*, and *Chaetomorpha linum*, of which the two species of *Gracilaria*, a genus whose members are known to proliferate under eutrophic conditions (Humm 1973b), accounted for 98 percent of the algal standing crop. Most of the algae were found unattached and free-floating on the bottom.

Benthic macrophytes were occasionally observed in the Big Bend area during the ecological studies conducted in the vicinity of the Big Bend power plant beginning in 1970. Limited qualitative information is available for two periods before modifications were made to the plant discharge canal, 1970-1973 (TECO, 1973) and 1975 (TECO, 1975a); up to that time the thermal discharge was released directly into the embayment south of the power plant. In addition, quantitative studies of benthic seagrass distribution in the area were conducted from 1977 to 1978, after the discharge canal was modified to discharge thermal effluents directly into Tampa Bay (Mangrove Systems, Inc., 1977, 1978a,b, 1979).

Data collected during the period 1970-1973 suggested that benthic macrophytes in the Big Bend area were sparsely distributed and of limited diversity. The seagrass Ruppia maritima and the macroalgae Gracilaria spp. and Ulva lactuca were the most common species.

During the summer of 1975, benthic macrophytes were collected at three sites (Figure 3-19) within the embayment south of the plant. Table 3-29 shows the distribution of macrophytes collected during the survey.

The limited qualitative studies conducted from 1970-1975 do not allow for a definitive evaluation of the effects of power-plant or other activities on macrophyte distribution.

During quantitative surveys conducted at Big Bend during 1977-1978, seagrass-sampling transects (Figure 3-20) were established in the dilution-pump intake canal (B-1), in the embayment south of the discharge canal (A-1, A-2, and A-3), and in a control area located south of the main study area. At quarterly intervals during the 2-year period, seagrass distribution and abundance were assessed. Sampling was conducted at 10-meter intervals along each transect. The distribution of seagrasses in the Big Bend and control areas are compared in Table 3-30 and Figure 3-21.

In the control transect, four seagrass species were observed: Ruppia maritima, Halodule (Diplanthera) wrightii, Syringodium filiforme, and Thalassia testudinum. Distinct patterns of areal zonation and seasonal abundance were evident. The inshore area was dominated by R. maritima during March, June, and September, with gradual seasonal replacement and ultimate dominance by H. wrightii during December of both years. An apparently new colony of T. testudinum was found during December 1977 in a small area seaward of the Ruppia and Halodule beds; this coverage continued through 1978. The offshore portion of the control transect contained only S. filiforme; density and degree of coverage remained fairly constant throughout the study period.

In contrast to the control area, only one seagrass species, R. maritima, was observed at the embayment stations. The degree of coverage and density varied widely during sampling. Ruppia were completely absent at sampling stations during September and December of both study years. Coverage and density were very low during both years on the transect (A-3) located at the former site of thermal discharge into the embayment. On the test transect near the dilution-pump intake, only limited coverage of H. wrightii was observed and this only during June 1977 and September 1978.

The differences between the transects in the control area and in the test areas near the plant may have resulted from past dredge-and-fill activities related to power-plant construction and to other development in the area (e.g., Apollo Beach residential communities), as well as possible thermal effects of power-plant operation.

Zooplankton

Studies carried out over the period 1970-1975 revealed that the zooplankton community in the area of Big Bend was typically dominated by copepods, of which cyclopoids were generally more abundant than calanoids. Copepod nauplii, pelecypod (bivalve) and gastropod veliger larvae, and polychaete larvae were also abundant. Organisms that were seasonally abundant included echinoderm and cirriped larvae, cladocerans, appendicularians, rotifers, and tintinnids.

Zooplankton studies were also conducted from January 1976 to March 1977 as part of an investigation for Units 1, 2, and 3 (Blanchet, Avery, and Leverone, 1977; Phillips et al., 1977) to evaluate the distribution, abundance, and entrainment potential for the planktonic stages of fish and benthic invertebrates (meroplankton).

Eggs from 12 families of fish were collected during the 15-month study. Two families, Engraulidae and Sciaenidae, accounted for 73 and 26 percent, respectively, of all eggs collected. The collections included larvae of 41 species of fish in 22 families. Again, engraulids were the most common larvae, accounting for 87 percent. Both fish eggs and larvae were taken during every month of the study. The greatest densities occurred during spring and summer; the lowest, during winter.

The bay anchovy (*Anchoa mitchilli*), an important forage species, was the most common engraulid. Bay anchovy eggs were first taken in early March and were collected regularly through late October; the greatest abundance occurred from April through July. The larvae of this species were collected from late March through early November, peak densities occurring from April through October.

Members of the economically important family Sciaenidae accounted for 26 and 4 percent, respectively, of all fish eggs and larvae collected during the 15-month study. Sciaenids occurred in relatively large numbers from early March through early November. Egg densities were highest in early April, May, and July. The specific identification of sciaenid eggs and early larvae is generally not possible. However, based on those larval stages that could be identified, sciaenids accounted for a larger number of species than any other fish family. The species collected included silver perch (*Bairdiella chrysoura*), sand seatrout (*Cynoscion arenarius*), spotted seatrout (*C. nebulosus*), spot (*Leiostomus xanthurus*), southern kingfish (*Menticirrhus americanus*), northern kingfish (*M. saxatilis*), and black drum (*Pogonias cromis*).

Larval clupeids, carangids, pomadasyids, sparids, and gobiids were also commonly taken in spring and summer, although each family accounted for less than 3 percent of all larvae collected. Winter samples were dominated by blenny and goby larvae, but numbers were usually low. The larvae of pinfish (*Lagodon rhomboides*), menhaden (*Brevoortia* spp.), and spot migrated into the study area during January and February. The seasonal occurrence of fish larvae in the Big Bend area during 1976-1977 is presented in Figure 3-22.

A total of 105 invertebrate taxa, of which 86 were decapod crustaceans (shrimp, crabs, etc.), were recorded from the meroplankton collections made from 1976 to 1977. Two peaks of abundance occurred, one in April and one in October. Larval decapods accounted for 94 percent of the larval invertebrates taken in the collections. However, nondecapod invertebrate larvae were undoubtedly underestimated because they passed through the mesh (363 micrometers) of the sampling nets. These small larvae are typically the numerically dominant meroplankton found in fine-mesh collections in the Tampa Bay area (Hopkins, 1977; Weiss, 1978).

Commercially important taxa included the larvae of Menippe mercenaria (stone crab) and Callinectes sp. (blue crab) and the postlarvae of Penaeus duorarum (pink shrimp). Although not one of the most abundant xanthid crabs in the meroplankton collections, M. mercenaria larvae commonly occurred from April through October. First-stage zoeae were most abundant (78 percent of all stone crab larvae collected), indicating that spawning occurred locally. Stone crab larval densities were somewhat greater inshore than at offshore stations. Seasonally, there were strong peaks in abundance during spring and fall. The larvae of Callinectes sp. were collected only rarely; a few were found between April and September. The postlarvae of pink shrimp occurred in low numbers, mostly during July and August.

Studies conducted at Big Bend from February 1979 to February 1980 (Phillips and Blanchet, 1980a) concentrated on the distribution, abundance, and entrainment potential of meroplanktonic stages of a select group of "representative important species" (RIS) of fish and invertebrates (Table 3-31). Meroplankton were collected at five nearshore and offshore stations in the vicinity of Big Bend (Figure 3-23). Using 505-micrometer-mesh plankton nets, two pairs of duplicate tows were made both day and night at approximately 2-week intervals. Additional analyses were conducted on selected samples collected at intake Station A to compare the distribution, abundance, and entrainment potential of RIS taxa with that of other meroplankton taxa (Phillips and Blanchet, 1980b). The results give a general idea of the presence and relative abundance of all meroplankton organisms collected in the 505-micrometer-mesh nets. However, the sampling interval for these selected samples (approximately 1 month) was too long to describe short-term temporal distribution patterns.

Mean density information on the planktonic stages of RIS collected during the 1979-1980 meroplankton studies is summarized in Figures 3-24 through 3-27.

The bay anchovy was the most abundant RIS taxon. Eggs and larvae were taken on all sampling dates between late February and early November, with sporadic occurrences of one or the other life stages through January (Figure 3-24). Mean egg densities were highest from April through July, while larvae were most abundant from April through August. A seasonal shift in the location of spawning was apparent: from March to June, egg densities were highest at the two stations (D and C) farthest upbay; during late June and early July, densities were highest at stations near the plant

(A and B); and from mid-July through September, densities were highest at the southern open-bay station (E). This trend was not evident with anchovy larvae; densities of this lifestage within the study area were highly variable.

Representative important species of the family Sciaenidae collected during 1979-1980 included silver perch, spotted seatrout, and black drum. A large number of unidentifiable eggs with characteristics common to the family were grouped as "Unidentified Sciaenid Eggs." (At least nine species of this family are known to occur in the Big Bend area.) Sciaenid eggs were found during all months of the study (Figure 3-25), highest densities occurring from April to August. Eggs were generally more abundant at stations in the vicinity of the power plant (A and B) except from late July through early August, when densities were greatest at offshore Station E. Other RIS taxa identified from the egg collections included Silver perch (Figure 3-26), Cynoscion spp., and black drum. Of these, silver perch was the most common. Larvae of this species were taken in February-September and January (Figure 3-26), spotted seatrout in March-October, and black drum in March-October and January.

The eggs and larvae of the scaled sardine (Harengula jaguana) were found from April to July (Figure 3-27). Eggs were most abundant from May to June; larvae, from May to July. Egg densities were greatest at offshore Station E, while larvae were most abundant at this station and at stations near the plant (A and B).

Larvae of the tidewater silverside (Menidia beryllina) occurred only rarely in collections made from March to July and in September, January, and February; they were taken only once at offshore Station E. The eggs of this species are demersal and therefore were not expected to occur frequently in plankton samples.

The selected samples collected from March to October contained the eggs and larvae of 16 additional species representing 13 fish families. Mean abundance data for all fish collected during the 8-month period are presented in Tables 3-32 and 3-33.

The eggs and larvae of the bay anchovy, an RIS fish, were more abundant than those of any other fish species in the selected samples, accounting for 50 and 74 percent, respectively, of all fish eggs and larvae. Unidentified Sciaenidae accounted for most (48 percent) of the other fish eggs. Other families represented by eggs included Soleidae, Carangidae, Clupeidae, and Triglidae. The scaled sardine ranked second in larval abundance (16 percent). Other species averaging more than 1 percent of total fish larvae were the feather blenny (Hypsoblennius hentzi) and the sand seatrout, which accounted for 1.5 and 1.1 percent, respectively.

Other commercially important non-RIS fish that were taken as larvae include the kingfish (Menticirrhus spp., 0.8 percent), the sheepshead (Archosargus probatocephalus, 0.2 percent), and pigfish (Orthopristis chrysoptera, 0.04 percent).

Of the invertebrate RIS taxa, only stone crab larvae and pink shrimp postlarvae occurred in the 1979-1980 collections. The presence of larvae of the eastern oyster (Crassostrea virginica) was demonstrated by oyster spat studies. However, these larvae were too small to be captured using 505-micrometer nets.

Stone crab zoeae were collected from early March through December (Figure 3-28), the greatest densities occurring from April to August. Early zoeal larvae were most abundant at stations near the power plant. Zoeae were usually least abundant in and at the mouth of Hillsborough Bay (Stations C and D). Stage I zoeae dominated the catch on all sampling dates at the stations near the plant, suggesting that spawning was occurring nearby. Late-stage zoeae were usually most numerous in the open waters of Tampa Bay (Station E).

The postlarvae of pink shrimp were low in density (1 to 41 per 100 cubic meters). They were first collected at open-bay Station E in May and at Stations C, D, and E in June, occurred sporadically at all stations through September, and then were only rarely collected through December. Greatest densities were observed during July and September.

Mean abundance data (number per cubic meter) for all taxa taken in the selected samples taken in the intake station from March to October are presented in Table 3-34. The invertebrates were dominated by the larvae of decapod crustaceans. The most commonly collected taxa were the pinnotherid crab Pinnixa sayana, which accounted for an average 35 percent of larval invertebrates; the xanthid crabs Eurypanopeus depressus, 19 percent, and Hexapanopeus angustifrons, 9 percent; the callianassid shrimp Upogebia affinis, 8 percent; and the xanthid RIS taxon Menippe mercenaria (stone crab), 5 percent. As a group, the family Xanthidae accounted for 40 percent of all larval invertebrates. Other common xanthid species were Rhithropanopeus harrisii, Panopeus herbstii, and Neopanope texana. One additional member of the family, Pilumnus spp., was only occasionally collected.

Greatest total densities of invertebrate larvae occurred during June. Pinnixa sayana was most abundant from May to July, and Upogebia affinis, in May and June. Larval stages of the Xanthidae were most common from April to June.

For most of the xanthid crabs, the earliest larval stages were the most common: 98 percent of stone crab larvae and 79 to 89 percent of the larvae of the remaining abundant xanthids (except Rhithropanopeus harrisii) were Stage I zoeae, suggesting that these species spawn close to the power plant. For the stone crab, likely adult habitats are the canals, riprap, and clumps of oysters occurring in the area.

The postlarvae of pink shrimp accounted for less than 1 percent of the total invertebrate meroplankton. Other penaeid shrimp included the genera Sicyonia and Trachypenaeus. The larvae of the brief squid (Lolliguncula brevis), which has commercial value in the Tampa Bay area as bait (Dragovich and Kelly, 1962), occurred during April and May.

Benthic Invertebrates

Studies of Tampa Bay have indicated that the bay system, in general, supports an abundant and diverse assemblage of benthic invertebrates. However, in Hillsborough Bay and several other areas of the bay system, dredge-and-fill operations and pollution, both domestic and industrial, have resulted in the presence of soft, highly organic sediments, a high biological oxygen demand, and low dissolved-oxygen concentrations, conditions that severely limit the distribution, diversity, and abundance of benthic invertebrates (Taylor, 1970). Surveys beginning in 1963 by the Bureau of Commercial Fisheries (now the National Marine Fisheries Service) revealed that species common in other parts of Tampa Bay--such as the brachiopod Glottidia pyramidata, the lancelet Branchiostoma sp., the phoronid Phoronis architecta, the quahog clam (Mercenaria campechiensis), and echinoderms--were either extremely rare or absent in Hillsborough Bay (Taylor and Saloman, 1967, 1968, 1970).

An extensive survey of the benthic mollusks was conducted during August and September 1963 at 45 stations throughout Hillsborough Bay (Taylor, Hall, and Saloman, 1971). Live mollusks, representing 36 taxa, were collected at only 26 of the 45 stations. Based on the occurrence and distribution of four species (Mulinia lateralis, dwarf surf clam; Amygdalum papyria, paper mussel; Nassarius vibex, common easter nassa; and Tagelus plebius, stout tagelus), 42 percent of the bay bottom was classified as unhealthy, 36 percent marginal, and 22 percent healthy (Figure 3-29). Most of the healthy stations were near the mouth of Hillsborough Bay. Other observations made during the study point to a significant decline of the benthic habitat in this area of Tampa Bay.

The benthic infauna in the main ship channel of Tampa Bay were studied in 1973 (Taylor, 1974) for the U.S. Army Corps of Engineers. All infaunal invertebrates, the annelid and arthropod groups in particular, were more abundant near the mouth of Hillsborough Bay than elsewhere in the bay system.

Early benthic studies at Big Bend were largely qualitative (TECO, 1975a; Virnstein, 1972). Studies from 1970 to 1975 in the nearshore areas near the plant revealed organism assemblages typical of a highly disturbed estuarine environment. The findings were attributed to the highly disturbed nature of the sediments in the area, likely a result of the extensive dredge-and-fill operations and other construction activities at the power-plant site, Apollo Beach, and nearby waterfront residential areas. The inshore sediments were fine silt combined with large amounts of what was thought to be fly ash. Open-bay areas were characterized by more coarse-grained sediments.

Seine and trawl collections were made from January 1976 to March 1977 in studies for Units 1, 2, and 3 (Figure 3-30; Comp, 1977). The crown conch (Melongena corona) was the most abundant large invertebrate collected by seine. It was concentrated primarily on the mudflats of the embayment south of the discharge canal. The blue crab (Callinectes sapidus) was collected by seine during all months of the year. Nearly half of those collected were also taken in the embayment.

Macroinvertebrate taxa were also taken during impingement studies during 1976-1977 (Peekstok, Page, and Haynes, 1977). These are listed, along with seasonal occurrence, in Table 3-35.

During aquatic ecology studies conducted at Big Bend during 1979-1980, seine and trawl collections (Tables 3-36 and 3-37, respectively) were made every month from March through January (Comp, 1980). The sampling stations are identified in Figure 3-31.

Forty-five non-RIS macroinvertebrates representing nine species were collected by seine (Table 3-38), the crown conch being the most abundant taxon (51 percent of the non-RIS catch). A total of 983 non-RIS macroinvertebrates representing 25 species were collected by trawl (Table 3-33). The penaeid shrimp, *Trachypenaeus constrictus*, accounted for 63 percent of the non-RIS catch; it was collected year-round but was most abundant in December and January. Seven other taxa were taken during impingement studies during 1979-1980 (Table 3-38).

A total of 337 benthic infaunal invertebrate taxa were recorded at Big Bend during 1976-1977 (Figure 3-32; Mahadevan et al., 1977). Nine species accounted for approximately 70 percent of the total number of organisms. The bivalve *Mysella planulata* was the dominant species (approximately 27 percent). The bivalve species referred to as the *Mulinia-Mactra* complex, in later studies identified as *Mulinia lateralis* (Mahadevan, Culter, and Yarbrough, 1980); the polychaete *Pseudopolydora* sp.; the amphipods *Ampelisca abdita*, *A. holmesi* (identified in the studies as *A. vadorum* and *A. verrilli*, respectively), and *Rudilemboides naglei*; and the cumacean *Cyclaspis varians* were other dominant taxa. The ostracods *Parasterope pollex* and *Haplocytherida setipunctata* were abundant during the spring and fall.

The polychaetes *Nereis succinea* and *Capitella capitata*, believed to be indicators of pollution (Logan and Maurer, 1975; Reish, 1972), were also collected during the study. *Nereis succinea* was abundant and persistent in the plant discharge canal, occurring in the largest numbers during the summer months. The relative abundance of *C. capitata* was greatest in the plant discharge canal and in the embayment and fingerfill canals south of the plant.

Studies of the benthic infauna were conducted during 1979 to evaluate the ecological effects of a shutdown of the Big Bend power-plant dilution pumping system (Figure 3-33; Mahadevan, Culter, and Yarbrough, 1980). The relative composition and distribution of the dominant invertebrates that were collected in 1979 are compared with the findings of the 1976-1977 studies in Table 3-39.

The comparison of these studies reveals a dramatic change in the area. The 1976-1977 studies revealed an abundance of mollusks and crustaceans. During 1979, the benthic infauna were composed mainly of polychaetes and other deposit feeders. During 1979, the general distribution of the dominant taxa near the plant discharge and in the embayment south of the discharge canal differed from that at all other stations studied. The results suggest the presence of "pioneer" conditions at these stations (i.e., an abundance of pollution-indicator and opportunistic species, particularly *N. succinea* and *Streblospio benedicti*). Species dominance changed over time at open-bay stations both within and outside the influence of the plant thermal plume, but these changes were limited to a few species. In December, the species composition changed dramatically at all stations; Mulinia lateralis, which had occurred only rarely before December, became the overall dominant species in the study area.

Considerable spatial and temporal variation in faunal density occurred in the study area during 1979. In general, density decreased from the initial sampling in May, the lowest densities occurring in August and September. The number of species per station generally decreased from high values in May and June to low values during the period from late August to November. It increased again during the month of December. Species diversity (the index H' of Shannon and Weaver, 1963) and equitability (the index J' of Pielou, 1966) varied in both space and time, but, considering the study area as a whole, values generally increased through early August and then declined through December. A faunal similarity analysis with the index $C\lambda$ of Morisita (1959) showed spatial and temporal variations in the benthic communities of the study area. The discharge canal stations and the station in the embayment south of the plant were generally dissimilar to all other stations.

A comparison of biotic and abiotic data collected during the 1979 studies at Big Bend revealed several trends. Spatial variations in water temperature appeared to influence benthic community characteristics. Temperatures were generally higher at the discharge and embayment stations than at open-bay stations. A direct relationship between water temperature and faunal distribution was observable only in areas where water temperatures were highest (approximately 6°C above ambient). For the study area as a whole, faunal abundance appeared to be related to temporal temperature patterns. Both the 1976-1977 and the 1979 studies indicated that the greatest density of benthic infauna in the study area occurs from November to April.

Spatial variations in salinity were minimal during 1979 and were not considered a controlling factor for fauna. However, temporal variations in salinity may have influenced the structure of the benthic community. In particular, the extreme reduction in salinity during late August (coupled with the high water temperature) may have contributed to the low densities of benthic invertebrates. Low dissolved-oxygen concentrations during the summer months were suggested as another possible factor.

Sediment type is generally considered the most important factor in benthic faunal distribution. With a few exceptions, bottom sediments were similar at the stations sampled during 1979. Some temporal variations in sediment type were noted at several stations, but there was no clear evidence that they had any effect.

A comparison of the results of the 1976-1977 and the 1979 benthic studies reveals differences in community parameters. In general, both density and species richness at all open-bay stations were considerably lower during 1979 than during 1976. Species diversity and equitability in 1979 were comparable to or greater than those in 1976, probably because of the reduced dominance of a single species. Differences in species composition and community parameters between the two study years were not restricted to the thermal areas; rather, they appeared to reflect an area-wide change in the benthic community. The dramatic change in benthic species composition, apparent from the 1979 studies, was viewed as the result of a combination of natural cyclic phenomena and perturbation of the entire Tampa Bay system owing to the extensive dredging activities of the Tampa Harbor Deepening Project. Sediments at most of the stations sampled in 1979 were generally more fine-grained than those reported in the 1976-1977 studies. The high density of the bivalve mollusk *Mulinia lateralis*, which occurred in the study area during December, has also been noted in other parts of Tampa Bay (J. L. Simon and J. L. Taylor, personal communications cited in Mahadevan, Culter, and Yarbrough, 1980), and this has also been attributed to dredging.

Studies on the rate of spatfall of the eastern oyster (*Crassostrea virginica*) were conducted from March 1979 to January 1980 at five stations in the Big Bend area (Blanchet, 1980). The findings indicate that spatfall first occurred in April and continued until December. Heaviest spatfall was in June, with a secondary increase during September and October. Some spatial variability was evident in the data.

Fishes

Juvenile and adult fish were collected by seine and trawl in the Big Bend area from 1970 to early 1977 and during 1979-1980. The objectives of the earlier studies were to determine the composition and the temporal and spatial distribution of the fish community in the vicinity of Big Bend and to evaluate power-plant effects on the community. The 1979-1980 study was designed to provide information on RIS fish taxa (Table 3-31) for assessing the potential effects of Big Bend Unit 4.

The fishes collected from 1972 to 1975 and occurrence by season are listed in Table 3-39. Fishes taken during impingement studies during 1972-1975 are listed in Table 3-40. The description of the fish community provided below relies primarily on the 1976-1977 studies; data collected from 1970 to 1975 were used for corroboration.

During 1976-1977, a total of 61,273 fish representing 56 species in 32 families were collected in 180 seine hauls (Figure 3-30; Comp, 1977). The tidewater silverside (*Menidia beryllina*) was the most common fish, followed in relative abundance by the bay anchovy (*Anchoa mitchilli*) and the longnose killifish (*Fundulus similis*). Most of the fish commonly collected in 1976-1977 also had been dominant during previous quantitative sampling in the study area.

During 1976-1977, most fish were collected in the shallow inshore areas; seine collections at one station (SB-10) in the northern embayment formed by Apollo Beach accounted for 38 percent of all individuals taken in the study. The fish collected at this station were predominantly juveniles of the striped mullet (*Mugil cephalus*), the spotfin mojarra (*Eucinostomus argenteus*), and the longnose killifish. Juveniles of many different species were often collected concurrently at this station. Somewhat similar observations were made at Stations SB-11 and SB-13. These findings suggest that the areas represented by these three stations served as nursery areas, the northern embayment apparently being the most important.

The seasonal distribution was generally similar at the various seine stations. With the exception of Station SB-12, the greatest abundance was observed during spring and fall; fish were least numerous during winter. At Station SB-12, fish were most abundant in winter. This station was near the power-plant discharge, which may have attracted fish during the period of low water temperatures.

Overall, the seine studies revealed the transient nature of the fish community in the Big Bend area. Most catches were generally dominated by a few species (two to six), but the dominants changed with time. Seasonal influxes of certain species caused shifts in community structure throughout the study period. This phenomenon was particularly pronounced at the "nursery" stations.

Fishes taken in impingement collections at Big Bend during 1972-1975 are listed in Table 3-41.

Seine and trawl collections were made from March 1979 to January 1980 as part of the Big Bend Aquatic Ecology Studies, whose purpose was to provide ecological data on select fish taxa for assessing the potential impact of Unit 4 (Figure 3-31; Comp, 1980). The numbers of RIS taxa collected are summarized in Tables 3-36 and 3-37.

Fewer bay anchovies were collected by seine during this study than in 1976-1977. Most fish collected in 1979-1980 were adults in spawning condition. However, in the earlier investigation, which included stations not sampled in 1979-1980, several thousand juveniles were taken. A total of 480 bay anchovies were collected by trawl during 1979-1980. Adults were taken during each sampling trip and were most abundant from November to January. Most individuals were collected in the intake canal.

A total of 862 scaled sardines (Harengula jaguana) were collected by seine, and most (562) were immature individuals taken during May; 91 percent were collected at Stations W and X.

The tidewater silverside was the most abundant and ubiquitous fish collected in seine hauls during 1979-1980. This species constituted 86 percent (i.e., 5661 individuals) of the total RIS fish catch. It was least numerous from June to July, but dominated the catches made on all other sampling dates.

The silver perch (Bairdiella chrysoura), typically a deep-water species, was not collected by seine but was the most abundant RIS fish taken by trawl (1711 individuals), primarily in the plant discharge canal. Silver perch were most numerous in June and July, when 1640 predominantly juvenile specimens were collected. Adults were more prevalent in catches taken during late fall and early winter.

Only one small spotted seatrout (Cynoscion nebulosus) was collected during the study, and it was taken by seine at Station Y in October. Local fishermen have reported a decline in the spotted seatrout catch in the Big Bend area (Comp, 1980). This was seen as possibly resulting from the normal cyclic abundance patterns of the population and/or the loss of seagrass habitat in the area.

A total of 46 black drum (Pogonias cromis), all juveniles and all taken in June at Station Y, were collected by seine. Black drum were never reported at this station in previous studies, but the presence of young individuals in the embayment suggests that the area may serve as a nursery for this species. Fifty-five black drum were collected by trawl. Most were taken from August to December in the plant discharge canal. Black drum are seasonally abundant in both the intake and discharge canals and are often caught by fishermen in large numbers there (Comp, 1980).

A total of 5416 non-RIS fish representing 47 species were collected by seine. The five most abundant species were the longnose killifish (1181), the spot (1018), the pinfish (794), the sheepshead minnow (477), and the rough silverside (Membras martinica, 386). These species accounted for 71 percent of the non-RIS seine catch. The trawl catch included 3106 non-RIS fish of 43 species. The five most abundant species collected were sand seatrout (1040), pinfish (380), sea catfish (Arius felis, 301), spot (281), and pigfish (Orthopristis chrysoptera, 274). These species comprised 73 percent of the total non-RIS trawl catch.

In general, the seasonal trends observed in non-RIS species composition and relative abundance during 1979-1980 are consistent with those observed in previous studies in the Big Bend area. Any differences could be attributed to the natural cyclic variations noted for many estuarine organisms.

Manatee

The Florida or West Indian manatee (Trichechus manatus) is listed as an endangered species by the Federal Government and by the Florida Game and Fresh Water Fish Commission. It is also considered threatened by the Florida Committee on Rare and Endangered Plants and Animals. In U.S. waters, manatees are protected by the Marine Mammal Protection Act of 1972.

The distribution of the manatee in Florida is continuous from Whitewater Bay to Charlotte Harbor, and is in greatest abundance on the gulf coast between Ten Thousand Islands and Charlotte Harbor. Farther north, semi-isolated populations occur in Hillsborough, Citrus, and Levy Counties. Manatees have been frequently sighted along the eastern shore of Tampa Bay, including Hillsborough Bay, and in the Little Manatee, Alafia, and Hillsborough Rivers. Winter congregations have been reported at Big Bend (Hartman, 1974). The U.S. Department of the Interior has listed the Little Manatee River below Route 301 and the Alafia River from the U.S. Highway 41 bridge west for 1 mile to its confluence with Tampa Bay as critical habitat for manatees in Hillsborough County.

TECO sponsored a study of the occurrence of the manatee in Tampa Bay and in the vicinity of the Big Bend site between November 1979 and February 1980 (Patton, 1980). The purpose was to document the use of the Big Bend warm-water discharge canal by manatees and to compare the significance of the site as a winter refuge against other refuges available in the area. Regular observations were made by plane, by boat, and also from the shore (including the superstructure of the existing Big Bend units). Manatee sightings were most common at the mouth of the Manatee River during the warmer months and in the warm-water refuges during colder months. The highest count during a single aerial survey was 55.

As a warm-water refuge, the Big Bend power plant ranked second in importance to the Gardinier Phosphate Plant on the Alafia River. As many as 10 manatees were observed at Big Bend during a single survey, while up to 42 were sighted at the phosphate plant during an overflight in February. The eastern end of the Big Bend discharge canal (except for the boat ramp area) appeared to be the region most regularly used by the manatees. The distribution of the animals within the canal did not appear to be correlated with specific water temperature levels.

Use of the area by manatees may increase with the increase in thermal discharges attributable to the operation of Big Bend Unit 4. Manatees could occur in the area during critical temperature drops in early winter, especially when the air temperature drops below 10°C and water temperatures in the thermal plume range from 16 to 20°C. They are not expected to remain in the area the entire winter, but should migrate to other nearby areas in Tampa Bay when the air and water temperatures increase. Their occurrence will also depend on food availability in the discharge area.

Manatees feed primarily on submerged vascular aquatic plants. The dominant foods in saltwater bays are *Thalassia testudinum*, *Syringodium filiforme*, *Halodule* (*Diplanthera*) *wrightii*, and *Ruppia maritima*. *Thalassia* and *Syringodium* are offshore forms that usually occur in waters of high salinity. *Halodule* and *Ruppia* are inshore species occurring under somewhat less saline conditions. Optimum feeding conditions for manatees are usually in water 1.0 to 1.6 meters deep.

Dolphins

Twenty-one species of cetaceans (dolphins and whales) have geographic ranges that could include Tampa Bay or adjacent waters of the Gulf of Mexico, but only the bottle-nosed dolphin (*Tursiops truncatus*) is expected to occur in the Big Bend area with any regularity. This species, like all cetaceans, is protected by the Marine Mammal Protection Act of 1972. During the Applicant-sponsored aerial survey of Tampa Bay from June 1979 to February 1980, a total of 66 dolphin herds representing 140 individuals were sited (Patton, 1980).

3.3.2 IMPACTS OF CONSTRUCTION

Construction of the Unit 4 discharge structure will have a primary impact on the aquatic environment. This structure will be located in the 350-foot-wide plant discharge canal east of the existing Unit 3 outfall. Approximately 690 cubic yards of sand and silt will be dredged from an area extending 80 feet in the canal, having an end width of approximately 65 feet, and tapering to roughly 24 feet at the existing bulkhead. The discharge structure will be constructed of steel sheet pile and will consist of two diverging walls approximately 50 feet long. When these walls are in place, a clamshell bucket will be used to dredge the material from between the walls. A silt barrier will be maintained during the operation. A tremie concrete floor (trapezoidal, 12 by 50 by 36 feet) and a riprap apron will be constructed to protect the canal bottom from erosion by the discharge flow. It is estimated that 3,205,000 benthic invertebrates will be removed in the dredge material. This estimate is based on a mean density of 10,111 individuals per square meter living in the sediment to a depth of approximately 10 centimeters. The benthic community in the discharge canal is dominated by species that are classified as opportunistic or as characteristic of thermally stressed areas (Mahadevan et al., 1977, 1980).

It is expected that those fish inhabiting the discharge canal would avoid areas of activity and would return after construction is completed. Manatees congregate occasionally in the warm waters of the discharge canal during the winter months. Discharge construction activities will be scheduled so as to cause minimal interference with the activities of this endangered species.

The intake structure for Unit 3 will be extended to provide for the Unit 4 circulating-water pumps and the fine-mesh-screen enclosure. Approximately 420 cubic yards of sand and silt will be dredged from a 50- by 55-foot area to accommodate the structure. Loss of some benthic invertebrates is expected. Silt barriers will be used during this construction.

During construction, the ground-water elevations in the immediate vicinity of Unit 4 will be lowered by the gravity dewatering system required for earthwork. The potentiometric surface of the affected ground water was determined during previous field-dewatering tests (Figure 3-34). The test results suggest that this dewatering activity will not have any noticeable effects on private or agricultural wells in the area, either in the available quantity of water or in its quality. Since the construction site is on a narrow peninsula, the ground-water quality in the area is highly influenced by, and similar to, the bay-water quality. The construction dewatering effluent will be discharged to the intake and discharge canals (NPDES Serial Nos. 012 and 013). After construction, the dewatering system will no longer be needed, and ground water will be allowed to rise to its natural elevation.

For construction of the bottom- and fly-ash disposal pond areas, it will be necessary to relocate Jackson Branch to a course east and north of the disposal areas (Figure 3-35). Approximately 2400 feet of channel will be bypassed and filled (a volume of some 15,250 cubic yards) and 2900 feet of new channel will be constructed. The new channel will be approximately 15 feet wide and will have a similar cross-sectional area, side slopes, and depth as the old channel, but its slope will be slightly flatter. It will tie into the existing Jackson Branch just south of the bridge on Big Bend Road. Cut material from the new channel will be used to fill the old channel or hauled to upland disposal sites. The relocated portion of the stream bed will initially have a substrate of disturbed, naturally occurring material, predominantly shelly sand. The stream bank will be allowed to revegetate naturally and is expected to resemble portions of the present stream bed after a few years. The productivity of the relocated portion of the stream will be appreciably decreased; however, since the stream-area inflow is small, it is expected that this loss of productivity will have no observable effect on Tampa Bay. The ash-disposal ponds will be diked for the 100-year flood, so there will be no stormwater discharge into the relocated Jackson Branch channel.

The construction of the gypsum storage and disposal areas will not disturb the main channel of Newman Branch. Small drainage swales and ditches (Figure 3-35), previously constructed to drain the area for agricultural use, will be filled before and during the use of this area for gypsum storage and disposal. These swales are triangular and, on the average, less than 5 feet wide and 1 foot deep. Approximately 38,000 linear feet of these swales will be filled during and as a result of the earthwork associated with dike construction and general site preparation. These swales and ditches are nontidal, and intermittent water courses. It is therefore expected that there will be little or no impact on the biota of Newman Branch or Tampa Bay as a result of their removal. Since the gypsum storage and disposal area will be diked for the 100-year flood, there will be no stormwater runoff from this area.

Dredge spoil and cut material from Unit 4 construction will be disposed of at either or both of the two dredge disposal areas (Figure 3-8) that were used for construction related to Units 1-3. The northeast disposal area consists of three cells and occupies about 22 acres. The largest cell is enclosed by earthen dikes that rise 20 feet above grade. The two smaller cells are diked to an elevation of 15 feet. The south disposal area is enclosed by a 20-foot dike and covers approximately 45 acres. Dredging associated with the construction and installation of the Unit 4 cooling water intake and discharge structures will yield 1110 cubic yards of spoil, which will be removed by clamshell and trucked to the disposal areas. No discharge from the disposal areas is expected.

Earthwork for the relocation of Jackson Branch and the construction of disposal areas for bottom ash, fly ash, and gypsum will be by dragline, bulldozer, or similar methods. Material cut during the construction of the new channel for Jackson Branch will be used to fill the old channel. Any excess cut material not used in filling the old channel or in the construction of the perimeter dikes around the bottom-ash, fly-ash, or gypsum areas will be disposed of in the dredge spoil disposal areas. Most of the spoil material will be relatively free of water and therefore no discharge from the spoil disposal areas is expected.

Maintenance dredging has been performed at Big Bend in the past, and it is conceivable that some maintenance dredging for Unit 4 will be necessary in the future. Depending on the location and volumes, either clamshell or hydraulic dredging will be used. At present, when material is hydraulically dredged to the disposal areas, overflow is discharged to the bay via the local canals. Effluent from the northeast disposal area is discharged into the canal north of the combustion turbines; discharge from the south disposal area flows to the canal immediately south of the area. The overflow from the process, other than being slightly more turbid, is similar to bay water. Adjustable flashboard risers and silt barriers are used for controlling the water quality.

The use of a temporary stormwater-drainage system and the rapid restoration of areas disturbed resulting from excavation will minimize site ponding, flooding, erosion, and sedimentation. Where traffic patterns and plant layout permit, slopes will be reseeded to minimize erosion. Natural recolonization by pioneer and early successional forms of native vegetation should supplement reseeding efforts. Where necessary, netting, straw, mulch, or pavement will be employed to stabilize topsoil. There will be no discharge of runoff degraded by construction of the unit building, the FGD system, and the limestone facilities. All such runoff will be intercepted and pumped to the wastewater-treatment pond.

The use of oils, petroleum hydrocarbons, and greases will be controlled during construction to prevent the materials from entering surrounding water bodies through the site-drainage system. Typical control measures include the use of nondraining impermeable slabs (where possible) or splash pans for liquid storage containers. Cleanup measures for oil- and liquid-waste spills will be established.

All construction-generated trash and solid waste will be properly disposed of off the site at an approved disposal site. Construction personnel will use either portable chemical toilets or a temporary sanitary system that uses a package-wastewater-treatment system. The wastes will be disposed of either by a licensed offsite contractor at approved locations or in the existing wastewater percolation and evaporation pond. These systems will be inspected and maintained regularly to prevent accidental spills or leaks.

3.3.3 IMPACTS OF OPERATION

The potential impacts of the operation of Unit 4 are discussed below. Consideration is given to the impacts of coal handling, the sulfur dioxide-control system, the particulate-control system, and the once-through cooling alternatives. The effects of freshwater usage and the wastewater-treatment system are also examined.

3.3.3.1 Impacts of Coal Handling

A coal-pile runoff collection and treatment system has been provided for Big Bend Station Units 1, 2, and 3 in order to achieve compliance with limitations established in the National Pollutant Discharge Elimination System (NPDES) permit. The system consists of an interception trench, a pumping station, and a runoff pond. It is designed to capture and retain runoff resulting from a design storm established by the U.S. Environmental Protection Agency (the most severe 24-hour storm that can be expected once in 10 years). Runoff resulting from storms in excess of these design conditions is discharged to Tampa Bay. To allow for Unit 4 coal storage, the coal-pile runoff pond will be eliminated. The existing interception trench will be expanded to encircle the new coal storage area and the pumping station will be relocated. The modified system will intercept all storm runoff and pump it to the existing demineralizer-waste sump for transfer to the wastewater pond.

Most of the leachate from the coal pile will be collected in ditches for transport to the wastewater pond. The amount of leachate that does infiltrate into the ground water is expected to be less than or equal to the natural recharge. The effects of the coal-pile leachate on the ground-water level, therefore, should be insignificant. Since the peninsula on which the plant is sited is dredged material, the ground water beneath the coal pile is bay water. The impact of the leachate on this water will have to be judged in terms of the quality of the intruded bay water and on the amount of leachate generated by the proposed expansion of the existing coal pile.

3.3.3.2 Impacts of Sulfur Dioxide Control

The FGD system will feature a limestone-scrubbing process that produces high-quality, coarse-grained gypsum as a byproduct. The gypsum has the following advantages over other FGD byproducts/wastes:

- Good dewatering properties due to the blocky and elongated nature of the calcium sulfate crystals
- The potential for use as an industrial raw material
- Good structural properties for land-based storage and disposal
- Minimal chemical oxygen demand of the leachate from stored waste

The limestone pile for the FGD system will be located on the peninsula and will cover an area of about 1.5 acres. The pile will be enclosed by a covered building to control limestone moisture. This will prevent runoff and leachate production that could have an adverse impact on surface-water and ground-water quality.

The gypsum storage and disposal site will consist of four separate tracts of land with a total area of 97 acres. Runoff from the gypsum storage and disposal site can directly affect surface-water quality, and leachate can directly affect ground-water levels and quality.

Berms designed to withstand a 100-year flood and storm surge will surround the entire gypsum storage and disposal site. Stormwater falling on the bermed area will be directed to temporary storage areas and allowed to percolate into the ground. None will be directly discharged into any body of water.

The volume of leachate entering the ground-water system should not exceed the normal ground-water recharge and, therefore, will have no hydrologic impact on ground-water flow. Rainwater infiltrating through the gypsum to the water table is a potential source of ground-water pollution. The permeability of the byproduct gypsum produced by the proposed Unit 4 is guaranteed by the vendor of the FGD system not to exceed 0.0002 foot per minute. The exact water quality of the FGD system leachate at the site will depend on site-specific factors.

Most available data on FGD byproduct leachates are representative of wet calcium sulfite sludges produced in existing FGD systems. These data are not representative of the material to be produced by the Big Bend Unit 4 FGD System. The Unit 4 FGD system will produce a material that is nearly pure calcium sulfate or gypsum. Since the FGD byproduct will be gypsum and the FGD system will be located downstream from the precipitator, the major contributor to leachate contamination is expected to be calcium sulfate. Ground water in the area is typically high in sulfates; therefore, little impact is expected. There are presently no Class I-B Florida water quality standards for calcium sulfate, calcium, or sulfates.

A recently released report (Electric Power Research Institute, 1981) discusses the effects of the stacking and landfilling of FGD byproduct gypsum from a test facility at Gulf Power Company's Plant Scholz in Sneads, Florida. The gypsum stack was formed by the stacking method used successfully in the phosphate fertilizer industry for the disposal of waste gypsum. The gypsum was sluiced to the disposal area at 5-10 weight percent solids. The decanted transport water was pumped back to the process for reuse. The gypsum settled to about 70 weight percent solids under the water surface.

The geology of the area (northern Florida) is very similar to that of Big Bend Station. The geologic sequence in ascending order consists of Eocene Gadsden Limestone, lower Oligocene Marianna Limestone, upper Oligocene Suwannee Limestone, Miocene Tampa Formation, and surficial soils of Pleistocene to Recent age. The surficial aquifer consists of silty and clayey sand 2 to 12 feet below the ground surface. The Floridan aquifer at the test stacking site averaged 60 to 65 feet below the ground surface. A liner was not installed within the gypsum-stacking areas. For ground-water monitoring, six observation wells were located in the silty and clayey soils of the surficial aquifer, two observation wells and two piezometers were placed in the aquiclude of the upper Tampa Formation, and three piezometers had collection zones in the Floridan aquifer of the Tampa Formation.

The stacking test period was from October 1978 through June 1980. The results of the monitoring program indicate the following:

1. No consistent increase in trace metals has occurred in either the surficial or the Floridan aquifer as a result of the operation of the disposal area.

2. Water quality within the deeper units of the Floridan aquifer has not changed from background conditions. Levels of all trace metals of concern are within the EPA interim primary drinking-water standards.

3. Water quality within the upper units of the Floridan aquifer immediately below the gypsum stack has improved slightly or has not changed.

4. Water quality within the surficial aquifer and within the aquiclude separating the surficial and the Floridan aquifers has improved slightly or has not changed.

It is important to note that approximately 12 feet of hydraulic head (decant water) was maintained throughout the test. This would tend to force leachate (if any) downward. Even with this driving force, however, no effects were found. The gypsum to be produced by the Big Bend Unit 4 FGD system will be conveyed (not sluiced) to the disposal area for stacking at about 90 weight percent solids. It will, therefore, have an insignificant hydraulic head, and the water in this drier gypsum will be purer than the process water used in the test stack.

3.3.3.3 Impacts of Particulate Control

Ash, a noncombustible component of coal, is produced when coal is burned in the steam-generator furnace. Two kinds of ash result when the coal is burned: "bottom" ash and "fly" ash. Bottom ash, which has a larger particle size than fly ash, falls to the bottom of the boiler furnace during the combustion process. Fly ash, which is fine particulate matter, leaves the furnace with the flue gases and is collected by electrostatic precipitators.

Bottom ash will be collected in a water-filled bottom-ash hopper and hydraulically sluiced to an earthen-diked pond in the area currently occupied by an unused U-shaped cooling pond (Figure 3-7). The conceptual layout of the area is shown in Figure 3-36. Overflow from the primary settling pond will flow by gravity to a secondary settling pond. Clarified water will then be pumped back to the plant, completing the recirculation system. The major portion of the bottom ash will settle in the primary settling pond. Once this pond is filled, the ash will be hydraulically dredged to an earthen-diked cell for final disposal. The estimated quantity of bottom ash to be produced is 25,680 tons per year.

Preliminary calculations using flow nets show that approximately 250 gallons per minute of water will seep out of the bottom-ash pond into the surficial aquifer. This estimate is based on conservative values of hydraulic head, berm width, and aquifer hydraulic conductivity. The analysis indicates that almost all of the seepage will occur on the north, south, and west sides of the pond. Seepage from the east side of the bottom-ash pond will be restricted because of the impermeable liner in the adjacent fly-ash pond.

Normal leakage at the site area from the Floridan aquifer through the Hawthorn Formation into the surficial aquifer is estimated to be 0.0065 gallon per minute per acre. This estimate is based on the fact that the potentiometric surface of the Floridan aquifer is 1 foot higher than that of the surficial aquifer. The construction of the bottom-ash pond will reverse the hydraulic gradient in the Hawthorn Formation so that 0.16 gallon per minute per acre will flow from the surficial aquifer into the Floridan aquifer directly beneath the pond. This estimate assumes a maximum hydraulic head differential of 29 feet between the water level in the pond and the potentiometric surface in the Floridan aquifer. Leakage into the Floridan aquifer is predicted to be 0.013 gallon per minute per acre for the area (10 acres) adjacent to the pond where the water level will be raised in response to leakage from the pond into the surficial aquifer. Maximum leakage directly beneath the pond into the Floridan aquifer will be 0.29 and 0.13 gallon per minute from adjacent areas where the ground-water table is raised. Total leakage into the Floridan aquifer from the bottom-ash pond is predicted to be 0.42 gallon per minute.

Seepage from the bottom-ash cells will result from rainfall percolation through the material. Since the cell will be diked, rainwater in the dikes will either evaporate or percolate into the ground; none will run off. According to the hydrologic budget for Hillsborough County (Menke et al., 1961), approximately 40 percent of the rain falling into the cells will percolate into the ground.

Table 3-42 lists data on the water quality of the efluent produced at four different bottom-ash-disposal areas (Utility Water Act Group (UWAG), 1979). Included are data on effluent from a southern Illinois coal that is the coal most similar to the type proposed for use at Big Bend. The results of these studies have shown that the predicted water quality of the bottom-ash leachates conforms to EPA Drinking-Water standards and Florida Department of Environmental Regulation ground-water standards.

The UWAG study methodology showed that the filtration of the bottom-ash effluents through clean, sieved sand produced an average reduction of 41 percent in the total arsenic concentration, 67 percent in total copper, 12 percent in total nickel, 33 percent in total zinc, and 38 percent in total manganese. These data are based on all fly-ash and bottom-ash effluents used in the study.

Migration of the leachate plume developing around the bottom-ash pond will be predominantly downgradient to the west. The native ground water in the Big Bend area has saline water characteristics, as evidenced by the relatively high concentrations of chloride, sodium, sulfates, and calcium in the surficial aquifer and the Floridan aquifer.

For these reasons, leachate from the bottom-ash-disposal area is not expected to have an adverse impact on ground-water quality at the site.

An alternative to the proposed unlined bottom-ash pond would be the installation of a high-density polyethylene liner, which would eliminate the seepage from the pond. Similarly, lined disposal cells would not allow the percolation of rainwater through the ash into the ground water. The estimated cost of liners for the pond and cells is $2.1 million.

Unit 4 fly ash will be removed from the flue gas by electrostatic precipitation, collected in hoppers, and pneumatically transported to silos for storage and subsequent sale as a raw material for the production of portland cement. To guard against a decrease in fly-ash demand, which could jeopardize the dependability of the unit, provisions for the disposal of fly ash from Unit 4 have been made. At times when it may be impossible to market Unit 4 fly ash, an ash-disposal system will be used. This system will also be used to dispose of economizer ash and pyrites removed from the coal before combustion. The conceptual layout of the fly-ash-disposal area is shown in Figure 3-36. The solids will be sluiced from the plant to a lined primary settling pond. Overflow from this pond to a lined secondary settling pond will be by gravity. Clarified water will be pumped back to the plant, completing the recirculation system. The rate at which these settling ponds fill with solids will depend on the vitality of the fly-ash market. When the ponds reach the point at which they must be cleaned, a final earthen-diked disposal cell will be constructed and lined. The ash will be hydraulically dredged to the disposal cell. The area to the south will be reserved for future disposal cells, as needed.

Leachate from the fly-ash pond can directly affect ground-water levels and quality. It is expected that the fly-ash pond will have minimal impact on the ground-water system at the site because the pond will be sealed with a liner having a very low permeability (0.0000001 centimeter per second).

3.3.3.4 Impacts of Once-Through Cooling

A once-through condenser-cooling-water system for Unit 4 would be basically similar to those for Units 1-3. The cooling water would be withdrawn from Hillsborough Bay via the existing intake canal and would be released into the station discharge canal through which it would flow back to the bay. There are several design alternatives that could be incorporated either singularly or in combination into the cooling-water system of Unit 4 to mitigate adverse impacts. These alternatives and their impacts are described in the following sections.

There are three principal concerns regarding potential impacts of once-through cooling-water systems: (1) thermal effects due to the heated discharge plume; (2) impingement (organisms being caught on the intake screens); and (3) entrainment (organisms passing through the screens and then through the cooling-water system).

Impingement and entrainment impacts can be mitigated by an intake structure of nonstandard design. The fine-mesh screen system proposed for Units 3 and 4 is such an innovative design. The thermal impacts of the discharge plume could be reduced by diluting the heated effluent with water of ambient temperature. Such a dilution pumping system could be used in conjunction with any of the once-through designs.

Conventional Intake Screens for Unit 4

Thermal Effects. The thermal impacts of Unit 4 on Tampa Bay were investigated by TECO using a predictive mathematical model (TECO, 1980c). The results of earlier studies had shown that the surface area enclosed by the 2°C isotherm is 692 hectares when Units 1-3 are at 100 percent load (Figure 3-37). The new study indicated that Unit 4 at 100 percent load would increase this area to 720 hectares (Figure 3-38). Also, the surface area swept during a tidal cycle by the 2°C isotherm would increase from 923 hectares to 983 hectares owing to the addition of Unit 4 (TECO, 1980c). Table 3-43 compares the projected temperatures of the Unit 4 effluent at the point of discharge with the monthly ambient bay-water temperatures.

Under the provisions of Section 316(a) and 316(b) of the Clean Water Act of 1977, TECO conducted biological studies to assess the combined effects of once through cooling for Big Bend Unit 4 and the existing cooling systems. Summarized in the paragraphs below are portions of the EPA Findings and Determinations for Unit 4 (Appendix D) relating to a conventional once-through cooling system that was proposed by TECO as the system of choice for Unit 4 in the Section 316 Demonstration document (TECO, 1980c).

Condenser-cooling-water withdrawal for the existing once-through system of Units 1, 2, and 3 is via a 25-foot-deep intake canal connecting to a 35-foot-deep ship channel leading to Hillsborough Bay. The rate of withdrawal is 537 cubic feet per second for each unit, which translates to a combined cooling water requirement of 1611 cubic feet per second. Based on plant design information, bay water circulating through the condensers will undergo a temperature rise of 9.3°C (16.8°F). Based on current thermal records for the point of discharge, temperature rises frequently exceed these values.

The general area of Hillsborough Bay receiving the heated discharge from Units 1, 2, and 3 is characterized by bottom sediments composed mainly of a sand-shell mixture, a general absence of seagrasses, and an abundance of benthic macroinvertebrates. The effects of the heated discharge on the benthic community were assessed in studies conducted in 1976 and 1979.

The operation of Units 1, 2, and 3 at 95 to 100 percent of their designed capacity and without the use of a dilution-assist cooling system will have an adverse thermal impact on approximately 30 hectares (74 acres) of benthic habitat in Hillsborough Bay. Including the discharge canal (16 hectares (40 acres)), a total of 46 hectares (114 acres) would suffer adverse environmental impact from the thermal discharge.

With the addition of Unit 4 to the Big Bend power plant, the current heat load to Hillsborough Bay is expected to increase by approximately 33 percent. Although temperature rises at the point of discharge will remain unchanged, the added thermal load to the bay will provide for an enlargement of the benthic area presently subject to adverse effects. Based on a linear extrapolation, the operation of Units 1-4 without dilution-assist cooling could potentially provide for an adverse impact to approximately 61 hectares (152 acres) of bay bottom.

The EPA concluded that the operation of Units 1-4 without a dilution-assist cooling system will potentially have an adverse thermal impact on this area of benthic habitat. The thermal impact, however, would not be viewed as substantial or unacceptable in terms of thermal damage to the benthic biota of Hillsborough Bay, because of the sandy, tide-swept nature of the benthic area subject to the impact and the fact that this area does not represent primary benthic habitat (i.e, seagrasses and other habitat-forming features; Appendix D).

Impingement. Studies were conducted at Big Bend Station during the periods 1976-1977 and 1979-1980 to determine the numbers of fish and invertebrates impinged on the intake screens of Units 1-3 (Peekstok, Page, and Haynes, 1977; Comp, 1980). Projections of impingement rates that would result from the addition of Unit 4 were also made. Based on the Applicant's Section 316 Demonstration (TECO, 1980c), the EPA determined that adding Unit 4 with conventional once-through cooling could increase existing impingement effects by approximately 33 percent and that impingement losses for four units are potentially adverse (Appendix D).

Entrainment. Several studies have also been conducted at the site to determine the extent of entrainment by Units 1-3 and to estimate the effects of entrainment by Unit 4 (Phillips et al., 1977; Phillips and Blanchet, 1980a, 1980b; TECO, 1980c). Table 3-44 contains estimates of numbers of eggs and larvae of selected representative important species that would be entrained annually by Units 1-4 if conventional intake screens were used on Unit 4. These estimates are based on abundance data collected during the 1979-1980 meroplankton studies. The EPA determined that entrainment losses for four units with conventional screens at Big Bend Station are potentially adverse (Appendix D).

Fine-Mesh Screens on Units 3 and 4

The potential thermal impacts of the Big Bend Station discharge plume would be the same for this alternative as those described above for conventional screens.

In conjunction with the planning for Unit 4 at Big Bend Station, a study was conducted to assess the applicability of those intake technologies used to minimize the entrainment and impingement of the biota of Hillsborough Bay. This study showed that a relatively new technology known as fine-mesh screening has potential application at Big Bend Station. Preliminary experiments led to the construction of a full-scale prototype traveling-screen device that included all the features of an in-service installation. The biological effectiveness of the new technology was then tested.

An evaluation of the system was made by the EPA (Appendix D). The findings are summarized in the following paragraphs.

TECO constructed and tested a prototype fine-mesh screening apparatus to determine its efficacy as an intake device to reduce entrainment effects associated with the operation of Units 1-4 with a once-through cooling system. Results of these tests are as follows:

The prototype device appeared to be approximately 56 percent effective in screening eggs and larvae from source water. Suggested changes in the design of the spraywash system, lifting buckets, and seals are proposed as a means of substantially improving the screening efficiency of the intake device.

Fish eggs and invertebrate larvae collected from the fine-mesh screen exhibited a low level of mortality. Many of the taxa involved were species of sport and commercial value (e.g., stone crab and drum).

Fish larvae collected from the fine-mesh screens or by plankton nets for control tests exhibited a high degree of mortality. The observed mortality, however, cannot be concluded to be solely due to impingement effects of the fine-mesh screen. Testing procedures (i.e., sampling and handling) can be viewed as factors contributing to the apparent low survival of the larval organisms. The immediate return of animals upon collection from the screening device may enhance the survival of fish larvae.

The proposed system for transport of animals to the dead-end waterway north of the plant appears to be an acceptable organism-return system. Additional testing is necessary to verify the dispersion of returned organisms to Hillsborough Bay.

The EPA determined that the placement of fine-mesh screening on the intake structures of Units 3 and 4 will minimize entrainment effects, and thus that the entrainment effects of Big Bend Units 1-4 will be approximately equal to the current impacts of Units 1, 2, and 3 using conventional intake technology and no dilution pumps. Impingement effects will also be reduced with this alternative.

Accordingly, TECO has proposed that fine mesh screens be used on the intakes of Units 3 and 4 at Big Bend.

The EPA has tentatively determined that the proposed cooling-water intake structure for Unit 4 reflects the best technology available for minimizing adverse environmental impacts in accordance with Section 316(b) of the Clean Water Act: (1) the location of the structure will be in the existing intake canal; (2) the design will be fine-mesh screens; and (3) the construction will require minimal dredging, and appropriate turbidity controls (silt barriers) will be used. With respect to capacity, the EPA recognizes that cooling towers would require less water for cooling than the once-through system; however, the use of fine-mesh screens on the intakes of Units 3 and 4 would limit impingement and entrainment to approximately the levels noted for Units 1-3 with conventional screens.

Fine-Mesh Screens on Units 1-4

The potential thermal impacts of the discharge of heated effluent from a cooling-water system incorporating this alternative would be the same as those of a conventional circulating-water system.

The numbers of organisms impinged and entrained as a result of the operation of Units 1-4 with this alternative would be less than those attributable to the operation of Units 1-3 with conventional screens. The feasibility of backfitting fine-mesh screens to Units 1 and 2 has not been examined in detail.

Dilution Pumping

A 316 Demonstration (TECO, 1977) for Big Bend Units 1, 2, and 3, which at the time included a dilution-assist cooling system, was evaluated by the EPA. This evaluation revealed that the location and capacity of the station's cooling-water facility were major factors in the unacceptable level of entrainment. The Applicant responded with a proposal to terminate use of the dilution-assist cooling system and to arrange for studies to assess the thermal and associated biological consequences of such action. The retirement of the dilution pump system would reduce the withdrawal capacity of the Big Bend facility by 36 percent and potentially effect a proportional reduction in the level of entrainment. The EPA Regional Administrator viewed the proposal as the basis for a reassessment of the impact of entrainment on Hillsborough Bay.

Results of the thermal and biological studies (Mahadevan et al., 1980) were evaluated by the EPA. The evaluation confirmed that a shutdown of the dilution-assist cooling system at Big Bend Station would not cause an unacceptable thermal impact on the aquatic resources of Hillsborough Bay. It also showed that such a shutdown would effect a significant reduction in the pumping requirements of the Big Bend facilities and would produce the expected reduction of 36 percent in entrainment (Appendix C).

Based on these findings, the EPA has not approved a dilution-assist cooling system for use with Unit 4.

3.3.3.5 Freshwater Use

The operation of Big Bend Unit 4 will have an indirect impact on the freshwater resources of the Tampa Bay area. Big Bend Units 1, 2, and 3 are presently served by the Hillsborough County South/Central Water System for its average freshwater need of 1.1 million gallons per day. The operation of the proposed Big Bend Unit 4 will require an additional 2.1 million gallons per day of fresh water. Approximately 1.1 million gallons per day of this additional water requirement are needed for operation of the FGD system.

Big Bend Station will rely on Hillsborough County to meet the additional freshwater demand of Unit 4. The County is in the process of studying its water systems and has included Big Bend Unit 4 in its long-range plans. There are no other plans for the diversion of water to large industrial users in the foreseeable future. The phosphate industry in central Florida is expected to peak in the 1990s, then begin a decline. Agricultural use is expected to remain constant or decrease. Projections are different, however, for municipal areas; according to the Hillsborough County Horizon 2000 Plan, municipal water use will increase significantly over the next several years. The increased pumping of water for industrial and growing municipal uses, combined with periods of severe drought, could bring about a substantial lowering of the potentiometric surface of the ground water and thereby permit local contamination by seawater.

The design of Big Bend Unit 4 will include an expansion of the existing recycling system, permitting significant savings of fresh water. Records show that the use of recycled water at the existing facility has cut potable water consumption by 21-23 percent.

3.3.3.6 Wastewater-Treatment Systems

TECO currently has three coal-fired generating units (1336 megawatts combined) operating at the Big Bend site. Wastewaters associated with the existing facilities are described in the NPDES permit for Units 1-3, which is included as Appendix B to this DEIS.

Through the NPDES permitting process, water quality standards and standards of performance for new sources (Appendix J) are applied to control the quantity and/or quality of the discharge of liquid effluents from Unit 4. Applicable Florida water quality standards are presented in Appendix K.

During the construction of Big Bend Unit 4, there will be two discharges associated with the installation of the circulating-water line: (1) construction dewatering discharge into the plant intake canal (NPDES No. 012) and (2) construction dewatering discharge into the plant discharge canal (NPDES No. 013). The point of discharge of No. 012 will be the eastern end of the intake canal. The point of discharge of No. 013 will be west of the Unit 3 condenser cooling-water discharge (NPDES No. 004), so that dewatering pumpage is not pushed into Jackson Branch during a rising tide.

Construction dewatering discharge will take place intermittently during the construction and installation of the circulating-water line. The frequency, quantity, and direction of discharge will depend on soil properties, the total length of excavated trench open at any time, and construction practices. It is estimated that there would be a discharge of 70,000 gallons per day based on an average discharge of 50 gallons per hour for 24 hours. Since Big Bend Station and the construction site are surrounded on three sides by the waters of Hillsborough Bay (including the intake and discharge canals), the quality of the surficial ground water at the circulating-water-line excavation (i.e., that water subject to construction dewatering) is estimated to be similar to that in the intake and discharge canals.

There will be no discharge associated with the construction of the Unit 4 building and related facilities. Surface runoff will be intercepted and pumped to the wastewater-treatment pond.

Discharges from the operation of Unit 4 will include (1) once-through cooling water (NPDES No. 008) or condenser-cooling-tower blowdown, depending on which cooling alternative is selected; (2) boiler blowdown (NPDES No. 009); (3) bottom-ash-system blowdown (NPDES No. 010); and (4) FGD-system blowdown (NPDES No. 011). A schematic of the plant water flow during the operational phase is presented in Figure 2-5.

Table 3-45 lists the continuous discharge streams, their expected contaminants, and the estimated concentrations of these contaminants. The combined effluents are the bottom-ash blowdown, the boiler blowdown, the FGD bleed stream, and the once-through cooling-water discharge.

The FGD-blowdown stream (70 gallons per minute) will be treated to remove suspended solids and adjust the pH to meet applicable effluent limitations.

The bottom-ash-sluice system (80 gallons per minute) will allow for the settling of suspended solids before the discharge of blowdown. Boiler blowdown (30 gallons per minute) will not require treatment to meet effluent limitations. These three streams will be combined with the circulating water (241,200 gallons per minute) a minimum of 350 feet upstream from the point of discharge to provide for complete mixing before discharge.

Data on heavy metals in the ambient intake water at Big Bend Station are available for three study periods during the years 1970-1981. The first set of data was collected during biological monitoring studies conducted from 1970 through 1974. The second set was collected from June through September 1980 in conjunction with fine-mesh screen studies for Big Bend Unit 4. A third set was collected during a study of the Big Bend slag pond from December 1980 through March 1981. The data from these studies have been submitted to the Florida Department of Environmental Regulation and the EPA in conjunction with the site certification application and the NPDES permit application. A summary of the available data and the applicable Florida Class III water quality standards is provided in Table 3-46.

The data for 1970 through 1974 indicate that the average and maximum values for cadmium, chromium, copper, lead, and mercury and the maximum values for iron and nickel in the ambient intake water were above applicable Florida water quality standards. No data for arsenic or selenium were collected.

The 1980 data indicate that the minimum, average, and maximum values for arsenic and selenium and the maximum value for mercury were above the applicable Florida water-quality standards.

The 1981 data, the most recent and detailed information available, indicate that the minimum, average, and maximum values for copper, lead, and mercury were above applicable Florida water-quality standards. However, the limit of detection for the chemical analytical method for lead is above the applicable Florida water quality standard. The average and maximum values for cadmium, chromium, and selenium and the maximum values for arsenic, iron, and nickel also exceeded the water-quality standards. This analysis is presented in Table 3-47.

From a review of the available data, it can be concluded that during various periods of time the concentrations of arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, and selenium violated the quality standards for ambient intake water.

Predictions of the water quality of the individual and combined discharge streams of Big Bend Unit 4 are presented in Table 3-48. The data show that there will be no detectable change in quality between the water at the intake point and that at the point of discharge. (Although it is possible to calculate very minor variations in the combined-discharge stream, these variations cannot be measured). The predictions for the combined discharge stream are is based on complete mixing within 350 feet of the circulating-water line before release into the discharge canal.

In view of the fact that the concentrations of certain heavy metals in the ambient water often violate water-quality standards, TECO, on April 13, 1981, applied for a variance from those applicable water-quality standards to allow the discharge into Hillsborough Bay of the combined waste stream from Big Bend Unit 4. In support of the variance request, TECO considered alternative treatments of the discharge streams to remove heavy metals, assuming the individual streams could be treated to meet water-quality standards before mixing with the circulating water. The cost of such treatment was estimated as $1.2 to $1.8 million (1985 dollars), depending on the treatment method selected.

The estimated water quality of the blowdown streams after further treatment to remove heavy metals is provided in Table 3-49. Included in this table are estimates of the water quality of both the individual and combined discharge streams for the different treatment alternatives. As indicated in these comparisons, there will be no measurable improvement in discharge-water quality as a result of the expenditure of an additional $1.2 to $1.8 million for further treatment.

Based on State and Federal regulations regarding the discharge of chlorine, the Applicant calculated a mixing zone for proposed Unit 4. The calculations assumed a constant release of 0.5 milligram per liter and used dilution factors (Table 3-50) based on chlorine data collected for Units 1, 2, and 3. From these calculations, it was determined that approximately 6.1 acres would have a chlorine concentration in excess of 0.01 milligram per liter. This area would be entirely contained within the discharge canal and would extend about 1081 feet from the Unit 4 discharge outfall. An evaluation of die-away is to be conducted in the near future and will be discussed in the final EIS.

Table 3-51 presents information on the effects of chlorine based on 96-hour LC_{50} toxicity data for species (or their congeners) that are indigenous to the Big Bend area.

A value of 0.2 milligram per liter is proposed as the limiting concentration for total residual oxidants (TRO) at the point of discharge. The rationale for this concentration is as follows:

1. Discharge limitations rarely exceed 0.2 milligram per liter.
2. The 96-hour LC_{50} data provided by TECO and other data available indicate that 0.2 milligram per liter falls within the range of tolerance for most organisms that could occur in the area.
3. Most of the affected organisms tested were juvenile. Generally, adult organisms can tolerate higher concentrations of chlorine, and adult species are more likely to be in the discharge canal; therefore, 0.2 milligram per liter was chosen, even though it is near the upper limit of the effects range.
4. Since the discharge canal is thermally stressed and has a positive discharge flow that tends to reduce the number of juvenile organisms present, a 6.1-acre mixing zone for chlorine should not have significant adverse effects.

Presently under review at the State and Federal levels is whether this limitation is adequate to protect aquatic organisms inhabiting the discharge canal. The resolution of this issue is expected before publication of the Final EIS. Should the TRO concentration of 0.2 milligram per liter be acceptable, it is expected that the State criterion of 0.01 milligram per liter would not be exceeded outside the proposed 6.1-acre mixing zone.

All in-plant freshwater-waste streams, both continuous and intermittent, are captured by the in-plant collection system and conveyed to the wastewater-treatment ponds. The treatment of the wastewater is limited to the removal of settleable solids within the settling basins and self-neutralization within the system of ponds. The spray-irrigation system provides for land application and disposal of that portion of the wastewater within the retention pond in excess of the demand for recycled wastewater at the plant. The spray-irrigation site consists of four separate-irrigation plots totaling 29 acres. Leachate from the wastewater-treatment ponds and the spray-irrigation site can directly affect ground-water levels and quality.

It is estimated that 300 gallons of water per minute seep out of the bottom of the wastewater pond into the unconfined aquifer. Approximately 0.48 gallon per minute leaks through the unconfined aquifer into the Floridan aquifer. Any increase in this seepage will cause the ground-water level in the unconfined aquifer to rise in the vicinity of the pond, thereby forming a ground-water mound.

The spray-irrigation rate is governed by pond level, seasonal conditions, and ground-water level. The overriding criterion for system operation is the avoidance of runoff from the sprayed area. When runoff is not a limiting condition, application rates of from 2 to 4 inches per week are common. This provides ultimate water disposal ranging from 254,400 to 508,800 gallons per day. It is conservatively estimated that approximately 36,000 gallons per day of recharge has been added to the normal recharge rate at the field as a result of the spray-irrigation operation. Consequently, a ground-water mound has been formed beneath the spray-irrigation field.

Certain waste streams from Big Bend Unit 4 will be channeled to the wastewater pond and sprayfield system currently used for the treatment of effluents from Units 1-3. The ground water at the Big Bend site has been designated as Class I-B in accordance with Florida water quality standards. Data on the wastewater pond and sprayfield system indicate that average concentrations of chromium, selenium, and mercury and maximum concentrations of arsenic and cadmium could exceed ground-water-quality standards. There are no data for lead concentrations, since the limit of detection for the lead test method is above the Florida water quality standard. The only feasible method of treating the waters of the wastewater pond and sprayfield system involves routing them to surface waters rather than allowing them to percolate into the ground water. Such treatment, however, would defeat the purpose of the existing treatment facilities and could increase the concentrations of the above elements in surface waters.

The potential potable water supply at the Big Bend site is the underlying Floridan aquifer. It is conservatively estimated that less than one-half gallon per minute will seep into the Floridan aquifer as a result of the operation of the existing wastewater-treatment system; hence, no impact on the water quality of the Floridan aquifer is expected. Moreover, the general direction of flow in the Floridan aquifer at the Big Bend site is westerly. Any well downstream of the wastewater-treatment system would have to be located between the treatment facilities and Hillsborough Bay on property owned by the Applicant. In view of this fact, TECO has requested a variance from the Florida water quality standards for the concentrations of chromium, selenium, mercury, arsenic, and cadmium in discharges from the wastewater pond and sprayfield system.

The plant complex is situated on dredge fill consisting typically of highly permeable sand and shell material. Stormwater runoff can cause site flooding and could transport pollutants to surface waters. The yard-drainage system consists of several open, grass-lined ditches feeding into concrete catch basins that discharge into Tampa Bay. The parking lot also drains into catch basins that subsequently discharge into the bay. Storage areas for oils, greases, and other petroleum hydrocarbons will be constructed so that spillage from these areas will not contaminate the stormwater. Roof drainage from Unit 4 will be conveyed to the bay. Runoff from the auxiliary building roofs will be drained to the ground, ultimately entering the yard-drainage system.

3.3.4 IMPACTS OF COOLING TOWERS

All types of mechanical-draft cooling towers considered will have similar impacts on the biota of the region, but the impacts on local water resources will vary according to the source of makeup water.

3.3.4.1 Impacts on Biota

The potential impacts of the thermal discharge would be the same for the mechanical-draft cooling-tower alternatives evaluated for Unit 4 regardless of the source of makeup water. The impact of the thermal plume resulting from the discharge of blowdown from the mechanical-draft towers will be much less than that associated with the once-through cooling alternative. The predicted temperature of the blowdown is shown in Table 3-52. The flow rate would be about 16 cubic feet per second and would be released into the discharge canal, where it will mix rapidly with the effluent from Units 1-3. No detectable change in the size, shape, or temperature of the plume from Units 1-3 is expected as a result of the operation of a cooling tower for Unit 4.

The numbers of organisms impinged upon or entrained by the makeup-water intake for the towers would be very small because of the volume of flow (about 24 cubic feet per second) and its location in the discharge canal. If the makeup intake were located in the intake canal, some increase in the numbers of organisms lost would result; however, the losses would still be quite small compared to those that would result from a once-through cooling system. There would be no impingement or entrainment impacts if treated wastewater or brackish water were used for makeup.

There would be some differences in the chemical composition of the blowdown from the towers depending on the source of makeup water. These differences are summarized in Table 3-53.

3.3.4.2 Impacts on Local Water Resources

Another issue of concern is the potential impacts of the cooling-tower alternatives on water resources.

Brackish-Water Cooling Towers

A ground-water investigation was conducted to evaluate the availability of brackish artesian water as an alternative source of cooling-tower makeup. Further investigations would be necessary before conclusions can be reached as to the feasibility of the brackish water as a makeup source and the environmental effects of pumping such water from the aquifer.

Freshwater Cooling Towers

The quantities of water needed for a closed-cycle system would place a great burden on the local ground-water resources. For this reason, efforts by the Applicant have concentrated on finding a feasible source of treated sewage effluent.

Table 3-20. Mean and range data for water temperature, salinity, and dissolved oxygen collected at selected meroplankton stations from February 1979 to February 1980[a]

Month	Temperature[b] (°C)		Salinity[b] (ppt)		Dissolved Oxygen[b] (mg/ℓ)	
	Mean	Range	Mean	Range	Mean	Range
1979						
February	16.8	16.0-17.5	24	23-26	8.8	7.8-9.7
March	18.6	17.5-20.0	23	19-25	9.5	7.2-15.8
April	23.8	23.0-25.0	25	23-27	8.0	4.2-10.8
May	26.4	25.7-28.0	23	19-26	7.8	2.8-12.3
June	28.9	27.0-31.0	23	21-27	7.6	0.7-14.0
July	30.4	27.0-32.0	23	19-28	6.9	0.9-11.8
August	29.3	27.5-31.0	23	17-26	7.1	0.7-14.6
September	28.0	27.0-29.5	18	8-25	6.5	1.6-9.9
October	26.3	25.5-27.5	16	9-22	7.7	1.4-12.8
November	21.4	20.0-23.0	22	18-25	8.8	5.6-11.0
December	16.9	16.0-18.5	24	21-26	9.0	5.7-11.4
1980						
January	17.5	16.0-19.0	24	22-26	9.0	5.3-12.8
February	14.6	14.0-15.0	23	19-28	9.4	6.8-11.6

Abbreviations:
ppt = parts per thousand.
mg/ℓ = milligrams per liter.

[a] Adapted from TECO (1980).
[b] Data from Stations A, C, D, and E. Refer to Figure 3-31 for station locations.

Table 3-21. Water-temperature data collected during benthic ecology studies at Big Bend, May to December 1979[a]

Station[b]	Avg. Depth (m)	Water temperature (°C)													
		May 11		June 21, 22		August 2		August 24		September 19		November 1		December 13	
		Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
1	6.1	33.8	28.5	36.5	32.0	38.0	33.0	37.5	38.0	35.5	35.5	30.5	31.5	25.5	23.0
2	6.8	33.9	28.0	36.0	30.0	38.0	35.0	37.5	32.0	15.5	31.0	31.5	26.5	24.0	23.0
3	1.2	33.8	32.0	32.0	29.0	34.5	34.5	37.0	30.5	31.5	31.5	28.0	28.0	23.0	23.5
4	2.7	27.7	27.4	30.5	28.0	32.0	32.0	30.5	29.5	29.5	28.5	23.5	23.5	20.5	19.0
5	4.0	27.6	26.8	29.0	28.0	32.5	31.5	31.0	29.0	28.5	28.0	24.0	23.5	20.5	18.5
6	5.5	27.3	26.8	28.5	28.0	32.0	30.5	31.0	29.0	28.0	28.0	23.5	23.5	19.5	18.5
7	6.1	27.5	26.8	28.5	28.0	31.0	30.0	29.5	29.5	27.0	28.0	23.0	23.5	20.5	18.0
8	3.4	28.0	26.6	32.0	28.0	34.0	31.5	30.0	29.5	30.5	28.5	26.0	24.5	19.5	18.5
9	3.6	27.4	26.6	28.5	28.0	33.0	31.5	29.5	29.0	28.5	27.5	24.0	23.0	19.5	18.5
10	3.4	28.4	28.1	30.0	29.0	31.5	30.5	29.0	28.0	27.0	27.5	23.0	23.5	19.5	18.5
11	4.2	27.8	26.2	30.5	27.5	31.5	30.0	29.0	28.0	27.5	27.5	23.5	23.0	21.0	18.0
12	5.7	28.4	26.0	29.0	28.0	31.0	30.0	28.0	27.0	27.0	27.0	23.5	23.0	20.5	18.0
13	6.5	28.2	26.2	28.0	27.0	31.0	30.0	29.0	29.0	27.0	27.5	23.0	23.5	21.0	18.0
14	1.1	31.0	30.9	32.0	32.0	34.0	34.0	33.5	33.5	32.5	32.5	27.5	27.5	22.5	22.0

Abbreviation: m = meters.

[a] Adapted from Mahadevan et al. (1980).

[b] Station locations are shown in Figure 3-33.

Table 3-22. Salinity data collected during benthic ecology studies at Big Bend, May to December 1979[a]

	Salinity (parts per thousand)													
	May 11		June 21, 22		August 2		August 24		September 19		November 1		December 13	
Station[b]	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
1	26.2	25.8	25.2	24.9	25.9	25.2	18.2	18.2	22.4	22.4	20.3	21.0	26.6	25.9
2	26.3	26.3	25.2	25.2	25.9	25.9	18.9	18.9	22.4	22.4	21.4	21.0	25.9	25.9
3	26.0	25.9	25.2	24.9	25.9	25.9	11.9	11.9	21.7	22.4	21.4	21.4	26.3	26.3
4	26.7	26.6	26.3	26.3	25.2	25.2	8.4	12.6	21.7	22.4	21.0	21.0	25.9	26.3
5	26.7	26.6	25.6	26.3	25.2	25.6	17.5	18.2	22.4	22.1	21.0	21.0	25.9	26.3
6	26.4	26.5	25.6	26.6	25.2	25.9	14.7	15.4	18.9	22.4	20.7	20.7	24.9	26.6
7	26.3	26.3	26.6	21.7	25.9	26.6	15.4	17.5	20.3	22.8	21.7	20.0	23.8	26.6
8	26.7	26.5	26.3	26.3	25.2	25.2	10.5	14.7	22.4	22.4	20.7	20.3	25.9	26.3
9	26.7	26.5	25.9	25.9	25.9	25.9	16.8	18.9	21.7	20.3	20.7	20.3	25.9	26.3
10	26.5	26.3	25.9	26.3	26.6	26.6	11.9	13.3	23.1	22.8	20.7	21.0	25.9	26.3
11	26.1	26.3	26.3	26.6	25.9	26.6	17.5	19.6	21.0	22.8	21.0	21.0	25.6	25.9
12	26.3	26.1	25.9	27.0	25.9	27.3	16.8	18.2	20.3	23.1	20.7	21.4	25.6	26.6
13	26.3	26.5	26.6	27.3	26.6	27.3	18.9	18.9	20.7	23.1	21.0	21.4	24.5	26.6
14	25.8	25.9	24.9	24.9	25.9	25.9	15.4	16.1	22.4	22.4	21.4	21.4	25.9	25.9

[a] Adapted from Mahadevan et al. (1980).

[b] Station locations are shown in Figure 3-33.

Table 3-23. Dissolved-oxygen data collected during benthic invertebrate studies at Big Bend, May to December 1979[a]

Station[b]	Dissolved oxygen (parts per million)													
	May 11		June 21, 22		August 2		August 24		September 19		November 1		December 13	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
1	4.7	3.3	6.1	3.5	5.7	4.3	5.6	5.3	6.1	5.3	7.3	6.1	7.7	6.6
2	5.2	3.5	5.4	2.7	5.3	4.2	5.7	3.6	6.5	4.5	6.6	2.6	7.8	7.1
3	5.0	4.6	6.6	4.7	4.7	4.7	7.4	6.8	7.1	6.8	7.8	7.8	7.7	7.4
4	6.5	5.3	6.7	4.5	8.7	7.9	7.6	5.1	9.1	5.3	8.4	8.4	7.7	6.5
5	7.4	5.2	6.9	2.0	6.8	3.6	6.7	4.8	7.1	5.9	7.4	7.2	8.7	7.5
6	6.5	4.6	6.1	2.6	7.0	2.4	6.8	3.7	7.8	5.0	7.4	7.3	9.4	6.7
7	6.0	4.4	7.5	6.2	7.3	3.9	6.6	5.4	7.3	5.1	7.8	6.2	9.3	7.2
8	7.0	5.5	5.3	2.1	5.5	3.5	8.5	6.4	8.7	4.6	8.5	7.6	8.3	7.2
9	7.0	5.2	5.2	4.5	6.9	4.8	8.2	5.8	8.4	4.6	8.4	7.2	8.8	7.1
10	8.6	7.8	8.3	6.8	7.9	5.0	7.2	6.2	8.3	6.7	8.0	7.6	8.9	7.9
11	7.7	3.5	7.9	3.2	7.3	3.0	7.2	4.6	8.4	6.2	7.9	7.8	9.7	7.5
12	7.8	3.7	7.6	3.0	7.0	3.0	6.6	4.7	8.3	4.7	8.1	7.6	10.3	7.0
13	7.3	4.2	8.2	5.5	7.1	2.7	7.1	3.7	8.5	5.7	8.3	7.9	9.4	6.7
14	9.2	9.1	5.7	6.0	7.0	7.0	8.0	7.6	9.1	9.1	9.8	9.8	7.5	7.4

[a] Adapted from Mahadevan et al. (1980).
[b] Station locations are shown in Figure 3-33.

Table 3-24. Water-quality data for Hillsborough Bay, Florida[a,b,c] (Sheet 1 of 2)

Parameter	Annual average ambient concentration			Florida Class III water standard[g]	Average composition of seawater[h]
	1972[d]	1978[e]	1979[f]		
Alkalinity, total	102.4				
Biochemical oxygen demand	1.8	3.1	2.9		
Calcium	335				413
Chloride	15,880				19,353
Chromium (total)	≤0.01			≤0.05[i]	
Color (platinum color units)	8.5	13.3	17.1		
Conductivity (μmhos/cm)	37,510	39,535	39,258		
Copper	≤0.01			≤0.015	≤0.002
Effective light penetration (inches)	61.7	32.4	32.2		
Fluoride	2.4	2.4		≤5.0	1
Hardness	4,494				
Iron, total	0.01			≤0.3	≤0.001
Lead, dissolved	≤0.01			≤0.05	
Magnesium	967				1,294
Nitrogen					
Total Kjeldahl	0.40	0.13	0.06		0.02
Total nitrate	0.05	0.02	0.03		
Ammonia	0.01	0.03	0.04		
Oxygen, dissolved	6.37	7.2	7.0	≥4.0	
pH (standard units)	8.02			6.5-8.5	8.1
Phosphorus, dissolved orthophosphate	1.89	1.22	1.07		0.073
Potassium, dissolved	272.6				387
Salinity (parts per thousand)	28.9	24.9	24.7		
Sodium, dissolved	8,382				10,760
Solids, suspended	13.2	42.6	61.0		
Sulfate (as SO_4)	2,098				2,712
Sulfide	0.03				

Note: See abbreviations and footnotes at end of table.

Table 3-24. Water-quality data for Hillsborough Bay, Florida[a,b,c] (Sheet 2 of 2)

Parameter	Annual average ambient concentration 1972[d]	1978[e]	1979[f]	Florida Class III water standard[g]	Average composition of seawater[h]
Turbidity (Jackson units)	4.7	5.9	4.6	50	
Water temperature (°C)	24.0	22.4	24.1		
Zinc	≤0.01			≤1.0	≤0.05

Abbreviations:
mhos/cm = micromhos per centimeter.
SO_4 = sulfate.

[a] Adapted from TECO (1980b).
[b] Average values from four Hillsborough County Environmental Protection Commission sampling stations (Nos. 9, 73, 80, 81) in Hillsborough Bay near the Big Bend Station.
[c] Values in milligrams per liter unless otherwise indicated.
[d] Hillsborough County Environmental Protection Commission (1973).
[e] Hillsborough County Environmental Protection Commission (1979).
[f] Hillsborough County Environmental Protection Commission (1980).
[g] Applicable to most of Hillsborough Bay.
[h] Martin (1970).
[i] After reasonable mixing of discharge in receiving water.

Table 3-25. Intake cooling-water quality at Big Bend Station[a,b]

Parameter	Minimum	Average	Maximum
pH[c,d,e]	7.3	--	8.5
Alkalinity, as $CaCO_3$[c]	102	154.2	300
Total solids[c]	23,550	25,199	26,580
Total suspended solids[f]	16.3	24.2	44.3
Nitrogen, nitrate as N[c]	<0.05	0.05	0.05
Phosphorus, total as P[c]	0.9	2.5	3.3
Sulfate, as SO_4[d,e]	1850	1892	1965
Phosphate[f]	0.667	0.768	0.922
Organic phosphorus[f]	0.005	0.169	0.206
Ammonia[f]	0.04	0.07	0.08
Nitrite (NO_2)[f]	0.005	0.005	0.006
Nitrate (NO_3)[f]	0.005	0.023	0.046
Bromide[d]	0.71	1.52	2.98
Chloride[c,d]	8326	12,774	19,813
Fluoride[c,d,e]	1.2	2.0	5.3
Aluminum[d]	<0.10	0.22	0.38
Antimony[d]	<0.2	0.5	0.8
Arsenic[d]	0.124	0.204	0.293
Beryllium[d]	<0.005	0.012	0.019
Cadmium[f]	0.001	0.001	0.001
Calcium[d]	116	276	330
Chromium[f]	0.006	0.022	0.045
Copper[f]	0.004	0.008	0.013
Iron[f]	0.01	0.05	0.08
Lead[f]	0.01	0.01	0.01
Magnesium[c,d]	122	407	905
Manganese[f]	0.01	0.02	0.04
Mercury[f]	0.0001	0.0001	0.0002
Nickel[f]	0.004	0.005	0.01
Selenium[d]	0.129	0.281	0.565
Potassium[c,d]	204	278	301
Sodium[c,d]	4550	7150	7600
Thallium[d]	<0.1	0.15	0.2
Oil and grease[f]	<1.0	1.5	1.9
Zinc[f]	0.007	0.008	0.011

Abbreviations:

$CaCO_3$ = calcium carbonate.
N = nitrogen.
P = phosphorus.
SO_4 = sulfate.

[a] Adapted from TECO (1981b).

[b] All except pH data in milligrams per liter.

[c] Water-quality data for period April 29, 1973, through May 5, 1973, Stone & Webster Engineering Corporation.

[d] Water-quality data for period October 15, 1979, through December 3, 1979, Tampa Electric Company Central Testing Laboratory.

[e] Water-quality data for June 26, 1979, Thorton Laboratories, Inc.

[f] 316 Demonstration - BB4, Fine Mesh Screen Study Report, Tampa Electric Company, November 1980, Station 1. Water-quality data from six samples collected during period July-September 1980.

Table 3-26. Jackson Branch and Newman Branch water-quality data[a,b]

Parameter	Collection location					
	1[c]	2[d]	3[e]	4[f]	5[g]	6[h]
pH (Units)	7.6	7.6	8.5	7.9	7.6	8.5
Turbidity (Jackson units)	<25	<25	<25	<25	<25	<25
Conductivity (mmhos/cm)	1100	7500	16,400	10,900	3100	15,500
Total solids	1064	5877	29,231	17,095	3011	27,783
Volatile total solids	38	794	5654	2725	476	4591
Fixed total solids	1026	5083	23,577	14,370	2535	23,192
Total suspended solids	9	16	48	14	4	47
Volatile suspended solids	7	6	10	7	0	8
Fixed suspended solids	2	10	38	7	4	39
Ammonia as N	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Kjeldahl nitrogen as N	<1.0	2.68	<1.0	1.0	1.45	<1.0
Nitrate as N	0.10	0.10	0.11	0.07	0.19	0.08
Total phosphate as P	3.29	2.12	0.75	0.97	1.07	0.78
Biological oxygen demand (3-day)	3.7	3.9	2.0	5.8	3.2	1.4
Chemical oxygen demand	75.6	(i)	(i)	(i)	(i)	(i)
Oil and grease	<2	<2	2.2	<2	<2	<2
Ortho phosphate	3.18	1.84	0.2	0.22	0.78	0.15
Chloride	72.5	2407	13,146	8281	1123	12,318
Fluoride	1.25	0.97	1.15	0.98	0.54	1.18
Sulfates	430.8	822.2	2048	1330	397.5	2285
Aluminum	0.12	0.20	0.42	0.46	0.39	0.27
Barium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium	171.9	204.2	310.4	159.2	100	291.7
Chromium	0.16	0.14	0.15	0.2	0.16	0.18
Copper	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Iron	0.53	0.38	0.05	0.03	0.86	0.03
Lead	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Magnesium	56.9	208.3	858	550	101.4	850
Mercury	<0.0002	0.0005	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	0.05	0.06	0.05	0.05	.05	0.04

Abbreviations:
mmhos/cm = millimhos per centimeter.
N = nitrogen.
P = phosphorus.

[a] From Tampa Electric Company (1980c).
[b] All units in milligrams per liter unless otherwise noted.
[c] 1 = Jackson Branch 100 yards east of transmission lines.
[d] 2 = Jackson Branch at Big Bend Road bridge.
[e] 3 = Discharge channel east of Unit 3 discharge.
[f] 4 = Canal embayment at trailer park.
[g] 5 = Newman Branch at Beach Road bridge.
[h] 6 = Apollo Beach north embayment.
[i] Could not be determined because of high salinity.

Table 3-27. Water quality of site ground water and suggested EPA standards[a,b]

	Surficial aquifer at site, March 1976[c]				Floridan aquifer[d]		
Parameter	West well	East well	South well	North well	1953	1974	EPA standards[e]
Phosphate, total	4.13	3.15	3.6	3.43			
Silica	47.9	45.4	14.8	44.2	21	28	
Calcium	692	155	176	1116	170	170	
Magnesium	173	51	53	384	65	52	
Sodium	10,000	18	17	300		50	
Potassium	1.9	0.5	1.6	1.4		3.1	
Iron, total	1.46	0.64	0.66	0.81	0.28	0.10	
Iron, dissolved	0.2	0.14	0.40	0.36			
Nickel	0.0	0.0	0.0	0.0			
Copper	0.01	0.01	0.01	0.01			1.0
Cadmium[f]	0.01		0.1	<0.01			0.01
Chromium	6.6	9.9	5.0	7.9			0.05
Lead[f]	<0.05		<0.05	<0.05			0.05
Mercury[f]	<0.002		<0.002	<0.002			
Selenium[f]	<0.5		<0.5	<0.5			0.01
Zinc	0.45	0.25	0.17	0.68			6.0
Manganese	0.12	0.18	0.18	0.24			0.05
Vanadium[f]	<1		<1	<1			
Sulfate	93.2	102.8	82.7	180.7	510	450	250
Chloride	2570	35	59	3317	88	100	250
Bicarbonate					172	173	
Nitrogen	0.56	0.89	0.22	0.78			
Nitrates	2.6	4.6	2.2	3.75			45
Arsenic[f]	0.28		0.05	0.06			
Bromine	8.6	0.1	0	12.5			
Phosphorus	0.04	0.22	0.2	0.08	0.4	0.6	
Biological oxygen demand	0	0	0	0			
Total dissolved solids	3641	4789	627	4329	1080	1000	500
Total suspended solids	50	35	14	59			
pH	7.00	6.96	8.35	6.4	7.3	7.3	
Oil and grease	0	0	0	0			
Turbidity (Ftu)	28	24	32	40			

Abbreviations:
EPA = U.S. Environmental Protection Agency.
Ftu = Formazin turbidity units.

[a] From TECO (1980).
[b] All data in parts per million unless otherwise indicated.
[c] Environmental Associates, Inc., analyses dated March 10, 1976.
[d] Duerr (1979).
[e] EPA standards for drinking water, primary and secondary.
[f] Interscience Associates, Inc., analyses dated December 15, 1975.

Table 3-28. Summary of water-quality data for the Floridan aquifer[a]

Parameter	Number of wells	Maximum	Minimum	Median
Chloride, mg/ℓ	90	3300	1	20
Sulfate, mg/ℓ	87	990	0	235
Hardness (Ca, Mg), mg/ℓ	52	2100	150	450
Specific conductance, µmhos	87	10,900	220	840
Total dissolved solids[b], mg/ℓ	87	8500	190	605

Abbreviations:

mg/ℓ = milligrams per liter.
Ca = calcium.
Mg = magnesium.
µmhos = micromhos.

[a] Adapted from Dames and Moore (1975).

[b] Total dissolved solids as a function of conductivity.

Table 3-29. Benthic marine algal and seagrass taxa reported from collections made at three sites in the embayment near Big Bend Station during 1975[a]

Taxon	Location of collection		
	Site I	Site II	Site III
Algae			
Chaetomorpha sp.	L	--	--
Cladophora sp.	L	L, SBL	SBL
Cladophoropsis sp.	L	L	L, SBL
Enteromorpha sp.	L, SBL	SBL	SBL
Ulva lactuca	L	L	L, SBL
Hypnea sp.	--	SBL	SBL
Laurencia sp.	--	SBL	SBL
Seagrass			
Halodule wrightii	SBL	SBL	SBL

Abbreviations:

L = littoral.
SBL = sublittoral.

[a] Adapted from TECO (1975a).

Table 3-30. Distribution and abundance of benthic seagrasses during surveys conducted at transects located in a control area and in areas near Big Bend Station during quarterly sampling in 1977 and 1978[a]

Transect	Sampling period							
	1977				1978			
	Mar.	June	Sept.	Dec.	Mar.	June	Sept.	Dec.
Control (116 quadrats)								
Ruppia maritima								
VQ	26	32	25	12	26	26	16	0
DEN	300	2500	1500	1300	2685	1850	1500	0
Halodule wrightii								
VQ	2	4	10	17	2	5	10	17
DEN	320	2600	1300	1400	1450	2100	3460	3000
Syringodium filiforme								
VQ	2	2	2	2	2	2	2	2
DEN	1950	2000	1970	1920	2175	2600	2225	2120
Thalassia testudinum								
VQ	0	0	0	2	1	1	1	1
DEN	0	0	0	60	600	700	650	600
B-1 (22 quadrats)								
Halodule wrightii								
VQ	0	1	0	0	0	0	1	0
DEN	0	2400	0	0	0	0	1750	0
A-1 (17 quadrats)								
Ruppia maritima								
VQ	14	10	0	0	10	5	0	0
DEN	950	920	0	0	1780	610	0	0
A-2 (37 quadrats)								
Ruppia maritima								
VQ	10	8	0	0	8	2	0	0
DEN	1100	9600	0	0	450	375	0	0
A-3 (37 quadrats)								
Ruppia maritima								
VQ	1	1	0	0	1	1	0	0
DEN	300	100	0	0	200	300	0	0

Abbreviations:

VQ = number of vegetated quadrats.
DEN = average density of seagrasses per square meter.

[a] Adapted from Mangrove Systems, Inc. (1979).

Table 3-31. Select "representative important species" chosen for concentrated study during the aquatic ecology studies conducted at Big Bend during 1979-1980[a]

Scientific name	Common name
Invertebrates	
Crassostrea virginica	Eastern oyster
Penaeus duorarum	Pink shrimp
Callinectes sapidus	Blue crab
Menippe mercenaria	Stone crab
Fishes	
Harengula jaguana	Scaled sardine
Anchoa mitchilli	Bay anchovy
Menidia beryllina	Tidewater silverside
Bairdiella chrysoura	Silver perch
Cynoscion nebulosus	Spotted seatrout
Pogonias cromis	Black drum

[a] Adapted from Mahadevan (1980).

Table 3-32. Mean abundance and relative composition of all RIS and non-RIS fish eggs reported from select meroplankton collections made in the intake canal (Station A) of Big Bend Station from March to October 1979[a]

Taxon	Mean number per 100 cubic meters	Percent of total
Anchoa mitchilli[b]	7671.81	49.988
Unidentified Sciaenidae[b]	7377.75	48.071
Unidentified Engraulidae	145.63	0.949
Bairdiella chrysoura[b]	90.50	0.590
Anchoa hepsetus	26.75	0.174
Unidentified Soleidae	19.81	0.129
Unidentified Carangidae	12.75	0.083
Cynoscion spp.[b]	0.62	0.004
Unidentified Clupeidae	0.50	0.003
Pogonias cromis[b]	0.48	0.003
Harengula jaguana[b]	0.36	0.002
Opisthonema oglinum	0.36	0.002
Unidentified Triglidae	0.05	0.001

Abbreviation: RIS = representative important species.

[a] Adapted from Phillips and Blanchet (1980b).
[b] RIS taxon.

Table 3-33. Mean abundance and relative composition of all fish larvae reported from select meroplankton collections made in the intake canal (Station A) of the Big Bend power plant from March to October 1979[a]

Taxon	Mean number per 100 cubic meters	Percent of total
Anchoa mitchilli[b]	337.75	74.421
Harengula jaguana[b]	74.00	16.305
Hypsoblennius hentzi	6.88	1.516
Cynoscion arenarius	5.08	1.119
Prionotus spp.	4.15	0.914
Bairdiella chrysoura[b]	3.94	0.868
Unidentified larvae	3.77	0.831
Menticirrhus spp.	3.41	0.751
Membras martinica	3.02	0.665
Gobiosoma robustum	1.98	0.436
Achirus lineatus	1.97	0.434
Microgobius gulosus	1.59	0.350
Unidentified Carangidae	1.31	0.289
Gobiesox strumosus	1.06	0.233
Archosargus probatocephalus	0.81	0.178
Unidentified Sciaenidae[b]	0.81	0.178
Pogonias cromis[b]	0.63	0.139
Oligoplites saurus	0.56	0.123
Chloroscombrus chrysurus	0.31	0.068
Orthopristis chrysoptera	0.19	0.042
Menidia beryllina[b]	0.13	0.029
Unidentified Soleidae	0.13	0.029
Unidentified Blenniidae	0.13	0.029
Cynoscion nebulosus[b]	0.11	0.024
Symphurus plagiusa	0.06	0.013
Syngnathus louisianae	0.03	0.007
Unidentified Clupeidae	0.03	0.007

[a] Adapted from Phillips and Blanchet (1980b).

[b] Representative important species.

Table 3-34. Mean abundance and relative composition of all invertebrate meroplankton reported from select collections made in the intake canal (Station A) of the Big Bend power plant from March to October 1979[a] (Sheet 1 of 2)

Taxon	Mean number per cubic meter	Percent of total
Pinnixa sayana	15.231	34.77
Eurypanopeus depressus	8.120	18.54
Hexapanopeus angustifrons	3.995	9.12
Upogebia affinis	3.359	7.67
Menippe mercenaria[b]	2.047	4.67
Unidentified Xanthidae	1.340	3.06
Balanus spp.	1.114	2.54
Rhithropanopeus harrisii	1.069	2.44
Polyonyx gibbesi	0.886	2.02
Pinnixa chaeopterana	0.815	1.86
Panopeus herbstii	0.750	1.71
Unidentified brachyuran	0.620	1.42
Alpheidae sp. A	0.591	1.35
Uca spp.	0.551	1.26
Unidentified Pinnotheridae	0.536	1.22
Neopanope texana	0.406	0.93
Polychaeta	0.278	0.63
Unidentified Grapsizoea	0.256	0.58
Palemonetes pugio/vulgaris	0.245	0.56
Sesarma reticulatum	0.235	0.54
Ogyrides limicola	0.219	0.50
Pinnotheres maculatus	0.204	0.47
Hippolyte spp.	0.101	0.23
Aegathoa sp.	0.088	0.20
Gastropod	0.085	0.19
Sesarma cinereum	0.078	0.18
Callianassa sp. D	0.070	0.16
Palaemonetes spp.	0.064	0.15
Periclimenes spp.	0.061	0.14
Pagurus longicarpus	0.042	0.10
Ambidexter symmetricus	0.034	0.08
Unidentified Porcellanidae	0.033	0.08
Paguridae sp. A	0.033	0.08
Penaeus duorarum[b]	0.033	0.08
Unidentified Caridea	0.033	0.08
Alpheidae sp. D	0.026	0.06
Alpheidae sp. B	0.023	0.05
Portunidae sp. B	0.021	0.05
Callianassa sp. A	0.019	0.04
Unidentified decapod	0.019	0.04
Callianassa sp. B	0.016	0.04
Persephone mediterranea	0.009	0.02

Note: See footnotes at end of table.

Table 3-34. Mean abundance and relative composition of all invertebrate meroplankton reported from select collections made in the intake canal (Station A) of the Big Bend power plant from March to October 1979[a] (Sheet 2 of 2)

Taxon	Mean number per cubic meter	Percent of total
Alpheidae sp. E	0.009	0.02
Unidentified Alpheidae	0.009	0.02
Naushonia sp.	0.007	0.02
Pilumnus spp.	0.005	0.01
Euceramus praelongus	0.003	0.01
Petrolisthes spp.	0.003	0.01
Lolliguncula brevis	0.003	0.01
Limulus polyphemus	0.003	0.01
Echinodermata	0.002	0.01
Unidentified Paguridae	0.002	0.01
Pagurus annulipes	0.002	0.01
Unidentified Callianassidae	0.002	0.01
Pagurus pollicaris	0.001	0.01
Brachyuran sp. B	0.001	0.01
Brachyuran sp. A	0.001	0.01
Callianassa sp. C	0.001	0.01
Pinnotheres sp. A	0.001	0.01
Unidentified Albuneidae	0.001	0.01
Palaemonetes intermedius	0.001	0.01
Sicyonia sp.	0.001	0.01
Trachypenaeus sp.	0.001	0.01
Bivalve mollusk	0.001	0.01
Paguridae sp. B.	0.001	0.01

[a] Adapted from Phillips and Blanchet (1980b).

[b] Representative important species.

Table 3-35. Seasonal occurrence of macroinvertebrate taxa reported from impingement collections made at Big Bend from January 1976 to March 1977[a]

Taxon	Jan.-March	April-June	July-Sept.	Oct.-Dec.	Jan.-March
Aurelia aurita	X	X	X	X	
Chrysura quinquecirrha			X	X	X
Aplysia willcoxi		X			
Lolliguncula brevis	X	X	X	X	X
Squilla empusa	X	X		X	X
Limulus polyphemus	X	X	X	X	X
Penaeus duorarum	X	X	X	X	X
Trachypenaeus constrictus	X	X		X	X
Alpheus heterochalis	X	X		X	X
Upogebia sp.		X			
Petrolisthes armatus	X			X	X
Petrolisthes sp.			X	X	
Pagurus longicarpus				X	X
Portunus gibbesii	X	X	X	X	X
Portunus sp.			X	X	
Callinectes ornatus	X	X			
Callinectes sapidus	X	X	X	X	X
Callinectes sp.			X	X	
Menippe mercenaria	X	X	X	X	X
Hexapanopeus angustifrons		X	X		
Neopanope texana texana	X	X	X	X	X
Eurypanopeus depressus	X	X	X	X	X
Panopeus herbstii	X	X	X	X	X
Sesarma cinerium	X	X	X	X	X
Sesarma reticulatum	X	X	X	X	X
Libinia dubia	X		X		X
Molgula sp.	X	X	X	X	X

[a] Adapted from Peekstok, Page, and Haynes (1977).

Table 3-36. Abundance of RIS taxa (invertebrates and fish) reported from seine collections at four stations near Big Bend from March 1979 to January 1980[a] (Sheet 1 of 2)

Taxon	Collection date by station																											
	3/14/79				4/10/79				5/10/79				6/5/79				7/3/79				7/31/79				8/28/79			
	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z
Penaeus duorarum	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Callinectes sapidus	4	0	1	0	4	0	0	0	0	0	0	1	1	0	0	0	2	1	1	0	0	1	0	0	0	0	1	1
Menippe mercenaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harengula jaguana	0	0	0	0	0	0	0	0	388	138	0	0	0	0	0	0	0	0	0	0	2	0	0	0	38	22	0	0
Anchoa mitchilli	1	0	0	0	3	0	0	0	0	0	7	0	13	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Menidia beryllina	168	43	37	1	69	14	111	0	396	64	341	1	6	0	19	5	1	4	12	3	8	1	183	239	531	25	311	8
Bairdiella chrysoura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cynoscion nebulosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pogonias cromis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	173	43	38	1	76	14	112	0	784	202	348	2	20	0	65	6	3	5	13	3	10	2	186	239	569	47	312	9

Note: See abbreviation and footnote at end of table.

Table 3-36. Abundance of RIS taxa (invertebrates and fish) reported from seine collections at four stations near Big Bend from March 1979 to January 1980[a] (Sheet 2 of 2)

	Collection date by station																				
	9/25/79				10/23/79				11/20/79				12/18/79				1/15/80				
Taxon	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z	W	X	Y	Z	Total
Penaeus duorarum	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6
Callinectes sapidus	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	20
Menippe mercenaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harengula jaguana	32	32	0	23	80	13	4	3	40	3	0	44	0	0	0	0	0	0	0	0	862
Anchoa mitchilli	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
Menidia beryllina	165	120	38	48	1020	2	337	6	250	2	4	102	555	48	0	123	150	68	21	1	5661
Bairdiella chrysoura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cynoscion nebulosus	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pogonias cromis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46
Total	197	152	38	71	1101	15	343	9	291	5	4	146	555	48	0	123	150	69	21	1	6621

Abbreviation: RIS = representative important species.

[a] Adapted from Comp (1980).

Table 3-37. Abundance of RIS taxa (invertebrates and fish) reported from trawl collections at five stations near Big Bend from March 1979 to January 1980[a]. (Sheet 1 of 3)

Taxon	Collection date by station																								
	3/14/79					4/10/79					5/10/79					6/5/79					7/3/79				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Penaeus duorarum	2	0	8	6	18	29	13	17	10	6	5	6	2	4	3	0	11	0	0	2	5	0	18	4	10
Callinectes sapidus	2	0	3	1	2	18	4	0	13	7	1	4	1	0	0	0	0	3	3	0	0	0	0	0	2
Menippe mercenaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harengula jaguana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anchoa mitchilli	6	0	10	8	3	0	0	3	2	3	3	4	6	0	2	1	19	8	0	0	1	0	0	1	5
Menidia beryllina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bairdiella chrysoura	0	0	4	0	0	0	5	0	0	1	6	958	1	0	2	6	662	3	0	2	3	0	1	0	0
Cynoscion nebulosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pogonias cromis	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	3	0	0	0	2	1	0	0	0
Total	10	0	25	15	23	47	22	20	25	17	15	975	10	4	7	8	695	14	3	4	11	1	19	5	17

Note: See abbreviation and footnote at end of table.

Table 3-37. Abundance of RIS taxa (invertebrates and fish) reported from trawl collections at five stations near Big Bend from March 1979 to January 1980[a] (Sheet 2 of 3)

Taxon	Collection date by station																								
	7/31/79					8/28/79					9/25/79					10/23/79					11/20/79				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Penaeus duorarum	11	3	31	0	10	56	3	45	0	5	16	9	28	3	16	2	106	61	25	26	34	63	27	11	7
Callinectes sapidus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	3	0	0	0
Menippe mercenaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harengula jaguana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anchoa mitchilli	2	5	6	5	2	4	0	4	0	2	8	0	3	6	8	18	3	3	3	1	131	8	1	2	6
Menidia beryllina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bairdiella chrysoura	0	0	1	1	0	1	0	1	0	1	1	2	1	0	0	6	5	1	9	0	2	2	4	0	2
Cynoscion nebulosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pogonias cromis	0	0	0	0	0	0	8	0	0	0	1	9	0	0	0	2	10	0	0	0	0	6	0	0	0
Total	13	8	38	6	12	61	11	50	0	8	26	20	32	9	24	29	124	66	37	27	167	82	32	13	15

Note: See abbreviation and footnote at end of table.

Table 3-37. Abundance of RIS taxa (invertebrates and fish) reported from trawl collections at five stations near Big Bend from March 1979 to January 1980[a] (Sheet 3 of 3)

Taxon	Collection date by station										Total
	12/18/79					1/15/80					
	A	B	C	D	E	A	B	C	D	E	
Penaeus duorarum	50	6	33	19	14	13	6	23	13	3	957
Callinectes sapidus	0	3	1	6	0	2	2	0	3	0	86
Menippe mercenaria	0	0	1	0	0	0	0	0	0	0	1
Harengula jaguana	0	0	0	0	1	0	0	0	0	1	2
Anchoa mitchilli	44	0	1	1	0	19	0	14	78	7	480
Menidia beryllina	0	0	0	0	0	0	0	0	0	0	0
Bairdiella chrysoura	10	1	1	0	0	1	1	0	0	3	1711
Cynoscion nebulosus	0	0	0	0	0	0	0	0	0	0	0
Pogonias cromis	1	5	0	0	0	0	3	0	0	0	55
Total	105	15	37	26	15	35	12	37	94	14	3292

Abbreviation: RIS = representative important species.

[a] Adapted from Comp (1980).

Table 3-38. Non-RIS macroinvertebrate taxa reported from Big Bend seine, trawl, and impingement collections made from March 1979 to February 1980[a] (Sheet 1 of 2)

Taxon	Type of Collection Seine	 Trawl	 Impingement
Aurelia aurita Moon jelly			X
Chrysaora quinquecirrha Sea nettle			X
Polinices duplicatus Moon snail		X	
Busycon contrarium Lightning whelk		X	
Melongena corona Crown conch	X	X	
Fasciolaria illium hunteria Banded tulip		X	
Oliva sayana Lettered olive		X	
Lollinguncula brevis Brief squid	X	X	X
Limulus polyphemus Horseshoe crab	X	X	X
Squilla empusa Mantis shrimp		X	X
Trachypenaeus constrictus Penaeid shrimp		X	X
Palemonetes pugio Grass shrimp	X	X	X
Pagurus longicarpus Hermit crab	X	X	
Pagurus pollicaris Hermit crab	X	X	
Pagurus sp. Hermit crab	X	X	
Hapatus pudibundus		X	
Persephona aquilonaris Purse crab		X	
Portunus gibbesii Portunid crab	X	X	X
Hexanopeus angustifrons Xanthid crab			X
Hexanopeus sp. Xanthid crab			X
Neopanope texana Xanthid crab		X	X
Eurypanopeus depressus Xanthid crab	X	X	X

Note: See abbreviation and footnote at end of table.

Table 3-38. Non-RIS macroinvertebrate taxa reported from Big Bend seine, trawl, and impingement collections made from March 1979 to February 1980[a] (Sheet 2 of 2)

Taxon	Type of Collection		
	Seine	Trawl	Impingement
Panopeus herbstii Xanthid crab			X
Unidentified xanthid Xanthid crab		X	X
Sesarma cinerium Friendly crab			X
Sesarma sp.			X
Pinnixa chaetopterana Commensal crab		X	
Libinia dubia Spider crab		X	X
Luidia clathrata Sea star		X	
Molgula sp. Tunicate		X	X

Abbreviation: RIS = representative important species.

[a] Adapted from Comp (1980).

Table 3-39. Comparison of the temporal and spatial distribution of the dominant benthic invertebrates collected at comparable stations near Big Bend during 1979 and 1976[a]

Station 79/76	May		June		August			September		November		December		Most dominant (less than or equal to 3) sampling periods	
	79	76	79	76	2-79	24-79	76	79	76	79	76	79	76	79	76
1/I1	S.b. C.v.	Mu.l. C.c. C.v. M.s.	N.s. S.m.	C.v. N.s. C.c.	N.s. Pa.p.	N.s. M.M.	N.s.	Mu.l. N.s. S.b.	N.s. M.s.	N.s. S.b. S.m.	M.s.	Mu.l.	M.s. Mu.l. N.s.	N.s. S.b.	N.s. M.p.
2/I16	S.b. C.v. A.d.	A.s. M.s.	B.s.	A.a. P.A. C.v.	N.s. H. B.c.	S.m. P.p. P.s.	N.s. M.s. A.s.	S.b. Pa.p.	A.s.	S.m.	A.s. C.s.	Mu.l. S.b. S.m.	p. C.s. A.s.	S.b. S.m.	A.s.
3-	C.v. O.s. A.h.	NCD	N.s. C.c. P.s. A.h.	NCD	N.s. C.c. H.s.	C.c. N.s. P.s.	NCD	H.s. C.c. N.s.	NCD	N.s. T.s. N.s.	NCD	H.s. Mu.l.	NCD	N.s. H.s. C.c.	
4/BC8	C.v. M.c.	P.p. R.n.	G.s. P.A.	P.p.	P.A.	M.c. Pa.p. O.	M.s.	M.c. Pa.p. O.	M.s. C.v.	Pa.p. M.c. G.s.	M.s. A.h.	Mu.l. M.c.	M.s.	M.c. Pa.p.	M.s.
5/BC7	C.v. G.s. M.c.	C.v. P.A.	P.A. Pa.p.	P.A. M.	Pa.p. P.A. P.say	N. Pa.p. G.v. P.A.	P.A. Pa.p.	S.b. Pa.p.	P.A. Pa.p.	Pa.p.	A.h.	Mu.l.	P.A.	Pa.p. P.A.	P.A.
6/BC6	C.v.	C.v. P.p. Pa.p.	O. N. M.c. Pa.p.	NCD	Pa.p. P.A. N.	G.v. Pa.p. H.	M.s.	Od.c. N. P.A.	NCD	Pa.p. S.b.	P.A. C.s. Er.	Mu.l.	NCD	Pa.p. N.	
7/BC4	M.c.	Cy. P.p. A.h.	Pa.p. M. P.A.	NCD	M.c. P.s. S.g. S.a.	M.c. P.A. H. P.say	Pa.p. M.c.	N. Pa.p. M.c.	NCD	Pa.p. O.	Pa.p. N. T. M.c.	Mu.l. M.c. N.s.	NCD	M.c. Pa.p.	
8-	C.v. A.a. M.s. M.c.	NCD	A.d.	NCD	S.r. Pin. Pa.p.	Pa.p. A.a. N.	NCD	Pa.p. O. M.c.	NCD	Pa.p. G.s. E.w.	NCD	Mu.l. M.c.	NCD	Pa.p. M.c. A.a.	
9-	M.c.	NCD	N. M.c. A.a.	NCD	Pa.p. G.s. N.	Pa.p. Od.c. O.	NCD	Pa.p. M.c.	NCD	Pa.p. M.c. E.w.	NCD	Mu.l. M.c.	NCD	M.c. Pa.p.	
10/E6	M.c.	P.p. Hap. R.n.	Pa.p.	M.s.	S.r. Pa.p.	N. O. Pa.p. S.r.	T. M.s.	Pa.p. O. N. M.c.	M.s.	M.c. S.b. Pa.p. G.s.	T. M.s. P.p. Hap.	Mu.l. M.c.	M.s. Hap.	M.c. Pa.p.	M.s. Hap.
11/E5	M.c. G.s. N.	P.p.	Pa.p. M.c.	C.v. Pa.p.	M.c. Pa.p.	Pa.p. T.	A.h. Pa.p. T.	T. Pa.p.	A.h.	E.w. Pa.p. G.s. M.c.	T.	Mu.l. M.c. O.d.c.	T. M. Pa.p.	M.c. Pa.p.	Pa.p. T.
12/E4	N. H.	P.p. M.	Pa.p. N. P.A.	NCD	Pa.p. H. P.A. N.	N. G.v. M. Pa.p. P.A.	M. Pa.p. P.A.	M. N. P.A.	NCD	Pa.p. S.b. G.s. Mu.l.	N. M.	Mu.l. Pa.p.	NCD	Pa.p. P.A.	M.
13/E2	N. H.	P.p. N. S.z.	N. P.A.	NCD	Pa.p. H. N.	G.v. Pa.p. P.A. P.say	Pa.p. M. P.p.	P.A. M.	NCD	S.b.	N. T.	Mu.l. M.c.	NCD	P.A.	
14/I17	A.a. A.h.	P.p. Hap.	A.h. A.a. Hap.	NCD	A.h. Hap.	N. Hap.	Hap. H.s. A.	C.c. S.b.	NCD	H.s. L.c.	Hap. A.h. C.v.	On. Mu.l. H.s.	NCD	A.h. Hap.	Hap.

Abbreviations:

A. = *Aricidea* sp.
A.a. = *Ampelisca abdita*.
A.h. = *Ampelisca holmes*.
A.p. = *Apoprinospio pygmaea*.
A.s. = *Anemone* sp.
B.c. = *Branchiostoma caribaeum*.
B.s. = *Balanus* sp.
C.c. = *Capitella capitata*
C.s. = *Caprellida* sp.
C.v. = *Cyclaspis varians*.
C.y. = *Cyclaspis* sp.
E.r. = *Erichthonius c.f. brasiliens*.
E.w. = *Eulimastoma c.f. weberi*.
G.s. = *Glycinde solitaria*.
G.v. = *Gyptis vittata*.
H. = *Hemichordata*. sp.

Hap. = *Haplocytherida setipunctata*.
H.s. = *Haminoea succinea*.
L.c. = *Laeonereis culveri*.
M. = *Minuspio cirrifera*.
M.c. = *Mediomastus californiensis*.
Mu.l. = *Mulinia*.
M.M. = *Myoida* (Miatella).
M.l. = *Mytilopsis leucophaeata*.
M.s. = *Mysella* sp.
N. = *Nematoda* sp.
N.s. = *Nereis succinea*.
O. = *Oligochaeta* sp.
O.d.c. = *Odostomia c.f. conoidea*.
On. = *Onuphis* sp.
O.s. = *Oxyurostylis smithi*.
P. = *Podocerus* sp.

P.A. = *Pseudopolydora* sp. A.
Pa.p. = *Paraprionospio pinnata*.
Pin. = *Pinnixa* sp.
P.say = *Pinnixa sayana*.
P.p. = *Parasterope pollex*.
P.s. = *Polydora socialis*.
R.n. = *Rudilemboides naglei*.
S.a. = *Sphenia antillensis*.
S.b. = *Streblospio benedicti*.
S.g. = *Syllis gracilis*.
S.m. = *Stenimonereis martini*.
S.r. = *Scoloplos rubra*.
S.z. = *Sarsiella zostericola*.
T. = *Tharyx* sp.
T.s. = *Tellina* sp.
NCD = No comparable data.

[a]Adapted from Mahadevan, Culter, and Yarbrough (1980).

Table 3-40. Seasonal occurrence of fishes in collections at Big Bend from 1972 to 1975[a] (Sheet 1 of 5)

Fish	Spring	Summer	Fall	Winter
Dasyatis americana Southern stingray		X		
Dasyatis sabina Atlantic stingray		X	X	
Dasyatis sayi Bluntnose stingray	X	X		X
Gymnura micrura Smooth butterfly ray	X	X	X	X
Rhinoptera bonasus Cownose ray		X	X	X
Elops saurus Ladyfish		X	X	
Anguilla rostrata American eel			X	X
Ophichtus gomesi Shrimp eel	X	X		X
Brevoortia patronus Gulf menhaden	X		X	
Brevoortia tyrannus Atlantic menhaden			X	
Dorosoma cepedianum Gizzard shad	X			X
Dorosoma pretenense Threadfin shad	X		X	
Harengula jaguana Scaled sardine		X	X	X
Opisthonema oglinum Atlantic thread herring		X	X	
Sardinella anchovia Spanish sardine			X	
Anchoa hepsetus Striped anchovy	X	X	X	X
Anchoa mitchilli Bay anchovy	X	X	X	X
Synodus foetens Inshore lizardfish	X	X	X	X
Arius felis Sea catfish	X	X	X	X
Bagre marinus Gafftopsail catfish	X	X	X	X
Opsanus beta Gulf toadfish	X	X	X	X
Porichthys porosissimus Atlantic midshipman	X	X		X
Gobiesox strumosus Skilletfish	X	X	X	X

Note: See footnote at end of table.

Table 3-40. Seasonal occurrence of fishes in collections at Big Bend from 1972 to 1975[a] (Sheet 2 of 5)

Fish	Spring	Summer	Fall	Winter
Ogcocephalus nasutus Shortnose batfish	X	X		
Urophycis floridanus Southern hake	X			X
Hyporhamphus unifasciatus Halfbeak		X	X	X
Strongylura marina Atlantic needlefish		X	X	
Strongylura notata Redfin needlefish	X	X	X	
Strongylura timucu Timucu	X	X	X	X
Cyprinodon variegatus Sheepshead minnow	X	X	X	X
Floridicthys carpio Goldspotted killifish		X	X	
Fundulus grandis Gulf killifish	X	X	X	
Fundulus similis Longnose killifish	X	X	X	X
Lucania parva Rainwater killifish			X	X
Membras martinica Rough silverside	X	X	X	X
Menidia beryllina Tidewater silverside	X	X	X	X
Hippocampus erectus Lined seahorse	X	X	X	X
Syngnathus floridae Dusty pipefish		X	X	
Syngnathus louisianae Chain pipefish	X		X	X
Syngnathus scovelli Gulf pipefish	X	X	X	X
Centropomus undecimalis Snook		X	X	X
Diplectrum formosum Sand perch	X			X
Epinephelus itajara Jewfish	X	X	X	X
Caranx hippos Crevalle jack	X	X	X	X
Caranx latus Horse-eye jack		X		
Chloroscombrus chrysurus Atlantic bumper		X	X	X

Note: See footnote at end of table.

Table 3-40. Seasonal occurrence of fishes in collections at Big Bend from 1972 to 1975[a] (Sheet 3 of 5)

Fish	Spring	Summer	Fall	Winter
Hemicaranx amblyrhynchus Bluntnose jack		X	X	X
Oligoplites saurus Leatherjacket	X	X	X	X
Selene vomer Lookdown		X	X	X
Trachinotus falcatus Permit		X	X	X
Trachinotus goodei Palometa		X	X	
Lutjanus griseus Gray snapper	X	X	X	X
Diapterus plumieri Striped mojarra	X	X	X	X
Eucinostomus argenteus Spotfin mojarra	X	X	X	X
Eucinostomus gula Silver jenny	X	X	X	X
Gerres cinereus Yellowfin mojarra		X	X	
Orthopristis chrysoptera Pigfish	X	X	X	X
Archosargus probatocephalus Sheepshead	X	X	X	X
Lagodon rhomboides Pinfish	X	X	X	X
Bairdiella chrysoura Silver perch	X	X	X	X
Cynoscion arenarius Sand seatrout	X	X	X	X
Cynoscion nebulosus Spotted seatrout	X	X	X	X
Cynoscion nothus Silver seatrout	X	X	X	
Cynoscion regalis Weakfish	X	X		
Leiostomus xanthurus Spot	X	X	X	X
Menticirrhus americanus Southern kingfish	X	X	X	X
Menticirrhus saxarilis Northern kingfish	X	X	X	X
Menticirrhus littoralis Gulf kingfish		X	X	X
Micropogon undulatus Atlantic croaker	X	X		X

Note: See footnote at end of table.

Table 3-40. Seasonal occurrence of fishes in collections at Big Bend from 1972 to 1975[a] (Sheet 4 of 5)

Fish	Spring	Summer	Fall	Winter
Pogonias cromis Black drum	X	X	X	X
Sciaenops ocellata Red drum	X	X	X	X
Chaetodipterus faber Atlantic spadefish	X	X	X	X
Tilapia melanotheron Blackchin mouthbrooder		X		X
Mugil cephalus Striped mullet	X	X	X	X
Mugil trichodon Fantail mullet	X	X	X	X
Labrisomus nuchipinnis Hairy blenny		X	X	X
Chasmodes saburrae Florida blenny		X	X	X
Hypsoblennius hentzi Feather blenny	X	X		X
Bathygobius soporator Frillfin goby	X	X	X	X
Gobiosoma robustum Code goby		X	X	X
Microgobius gulosus Clown goby	X	X		X
Peprilus alepidotus Harvestfish		X	X	X
Prionotus scitulus Leopard searobin	X	X	X	X
Prionotus tribulus Bighead searobin	X	X	X	X
Paralichthys albigutta Gulf flounder	X	X	X	X
Paralichthys dentatus Summer flounder		X	X	
Achirus lineatus Lined sole	X	X	X	X
Trinectes inscriptus Scrawled sole			X	
Trinectes maculatus Hogchoker	X	X	X	X
Symphurus plagiusa Blackcheek tonguefish	X	X	X	X
Aluterus schoepfi Orange filefish		X	X	X
Monacanthus hispidus Planehead filefish	X	X	X	X

Note: See footnote at end of table.

Table 3-40. Seasonal occurrence of fishes in collections at Big Bend from 1972 to 1975[a] (Sheet 5 of 5)

Fish	Spring	Summer	Fall	Winter
Lactophrys quadricornis Scrawled cowfish	X	X		X
Sphoeroides nephelus Southern puffer	X	X	X	X
Sphoeroides spengleri Bandtail puffer			X	
Chilomycterus schoepfi Striped burrfish	X	X	X	X

[a] Adapted from TECO (1976).

Table 3-41. Fish taxa reported from impingement studies conducted at Big Bend Station during 1972-1975[a]

Dasyatis sayi
Gymnura micrura
Unidentified rajid
Elops saurus
Callechelys sp.
Ophichthus gomesi
Brevoortia patronus
Brevoortia sp.
Dorosoma cepedianum
Harengula jaguana
Opisthonema oglinum
Anchoa hepsetus
Anchoa mitchilli
Synodus foetens
Arius felis
Bagre marinus
Opsanus beta
Porichthys porosissimus
Gobiesox strumosus
Ogcocephalus nasutus
Urophycis floridanus
Ophidion holbrooki
Hyporhamphis unifasciatus
Strongylura timucu
Fundulus similis
Membras martinica
Menidia beryllina
Hippocampus erectus
Syngnathus louisianae
Syngnathus spp.
Caranx bartholomaei
Caranx hippos
Caranx latus
Chloroscombrus chrysurus
Hemicaranx amblyrhynchus
Oligoplites saurus
Selene vomer
Lutjanus griseus
Diapterus plumieri
Eucinostomus argenteus
Eucinostomus gula
Orthopristis chrysoptera
Lagodon rhomboides
Bairdiella chrysoura
Cynoscion arenarius
Cynoscion nebulosus
Leiostomus xanthurus
Menticirrhus americanus
Menticirrhus saxatilis
Menticirrhus sp.
Micropogon undulatus
Pogonias chromis
Sciaenops ocellata
Chaetodipterus faber
Mugil cephalus
Hypsoblennius hentzi
Peprilus alepidotus
Prionotus scitulus
Prionotus tribulus
Paralichthys albigutta
Achirus lineatus
Trinectes maculatus
Unidentified soleid
Symphurus plaguisa
Alutera scripta
Monacanthus hispidus
Lactophrys quadricornis
Sphoeriodes nephelus
Chilomycterus schoepfi
Diodon holacanthus

[a] Adapted from TECO (1975b).

Table 3-42. Data on water quality of effluents produced at four different bottom-ash-disposal areas[a,b]

Component	Effluents[d] A	B	C	D	Avg. A+B+C+D	EPA standard[e]	FDER[c] ground-water quality standard
Iron, total	0.90	0.91	0.98	0.71	0.88		
Iron, dissolved	0.03	0.06	0.05	0.03	0.043		
Nickel	0.009	0.02	0.03	0.02	0.02		
Copper	f	0.008	0.03	0.004	0.014		
Cadmium	0.001	f	f	f	0.001	0.01	0.01
Chromium	f	f	f	0.006	0.006	0.05	0.05
Lead	f	f	f	f		0.05	0.05
Mercury	f	f	f	f		0.002	0.002
Selenium	f	f	f	f		0.01	0.01
Zinc	0.007	0.13	0.03	0.01	0.044		
Manganese	0.10	0.29	0.15	0.01	0.138		
Arsenic	f	f	f	0.01	0.01	0.05	0.05
Antimony	f	f	f	f			
Beryllium	f	f	f	f			
Silver	f	f	f	f		0.05	
Titanium	f	f	f	f			
Total dissolved solids							
Total suspended solids		4.6	7.7	55.6			
pH	7.8	6.8	7.8	8.4			

Abbreviations:

EPA = U.S. Environmental Protection Agency.
FDER = Florida Department of Environmental Regulation.

[a] From Tampa Electric Company (1981a).

[b] Values are in milligrams per liter and were obtained from Utility Water Act Group (1979).

[c] Florida Administrative Code, Chapter 17-3.101.

[d] The following letters identify the coal type for each pond from which the samples were taken:

A. Western West Virginia coal
B. Eastern Ohio coal
C. Southern Ohio coal
D. Southern Illinois coal

These effluents were used to provide conservative estimates of leachate quality. Data do not account for renovation during movement through soils.

[e] National interim primary drinking water standards.

[f] Values less than the minimum quantifiable concentration from Utility Water Act Group (1979).

Table 3-43. Comparison of temperatures of the effluent from Unit 4 at the outfall with seasonal ambient water temperatures for the once-through cooling alternative[a]

Season/month	Ambient water temperature[b] (°F)			Discharge-water temperature (°F)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
Winter						
January	66	54	59.6	83	71	76.6
February	63	50	57.9	80	67	74.9
Summer						
March	75	58	66.4	82	75	83.4
April	85	67	76.8	102	84	93.8
May	85	73	80.0	102	90	97.0
June	89	81	85.6	106	98	102.6
July	94	82	87.2	111	99	104.2
August	90	79	86.1	107	96	103.1
September	88	82	85.4	105	99	102.4
October	84	71	76.9	101	88	93.9
Winter						
November	79	67	73.4	96	84	90.4
December	77	62	68.7	94	79	85.7

[a] Adapted from TECO (1981b).

[b] Intake cooling-water data for 1978.

Table 3-44. Estimates of numbers of individuals of the "representative important species" that would be entrained annually by Big Bend Units 1-4 at 100 percent flow with conventional intake screens (3/8-inch mesh)[a]

Species and life stage	Projected annual entrainment
Pink shrimp postlarvae	18.6 million
Blue crab larvae	0
Stone crab larvae	2.4 billion
Bay anchovy	
Eggs	96.5 billion
Larvae	11.2 billion
Scaled sardine	
Eggs	60.0 million
Larvae	1.8 billion
Tidewater silverside	
Eggs	0
Larvae	1.6 million
Silver perch	
Eggs	8.8 billion
Larvae	31.4 million
Spotted seatrout	
Eggs	0
Larvae	6.3 million
Unidentified fishes of seatrout genus	
Eggs	29.0 million
Larvae	470 thousand
Unidentified fishes of drum family	
Eggs	42.3 million
Larvae	7.2 million
Black drum	
Eggs	82.6 billion
Larvae	3.2 million

[a] Adapted from TECO (1980c).

Table 3-45. Continuous-discharge stream water quality[a,b] (Sheet 1 of 2)

Parameter	Intake cooling-water concentration[c]			City water concentration[d]	Boiler blowdown	Bottom-ash blowdown[e]	FGD system blowdown[f]	Combined effluents[g]	Florida Class III WQ standard
	Average	Minimum	Maximum						
Flow (gpm)	241,000				30	80	70 (max.)	241,180	
Alkalinity	154.2	102	300	168					
Total solids	25,199	23,550	26,580	500	10	500 (min.)	91,300		
Total suspended solids	24.2	16.3	44.3	20	4	30	30		
Nitrate nitrogen	0.05	<0.05	0.05	<0.05		<0.05	<0.05		
Phosphorus	2.5	0.90	3.3	<0.1		<0.01	<0.10		
Sulfate	1892	1850	1965	44		44	55,700	1980	
Phosphate	0.768	0.667	0.922						
Organic phosphorus	0.169	0.005	0.206						0.001[h]
Ammonia	0.07	0.04	0.08		2				
Nitrite	0.005	0.005	0.006						
Nitrate	0.023	0.005	0.046						
Bromide	1.52	0.071	2.98	0.48		0.48	0.48	2.9781	Bromine, 0.1; bromates, 100
Chlorine								<0.2 FAC	<0.01 TRC
Chloride	12,774	8,326	19,813	23		23	26,200	19,806	Maximum 10% above background
Fluoride	2.0	1.2	5.3	0.5		0.50	0.50	5.2964	5.0
Aluminum	0.22	<0.1	0.38						1.5
Antimony	0.50	<0.2	0.80			(i)			0.2
Arsenic	0.204	0.124	0.293		0.193	0.02	0.250	0.2929	0.05
Beryllium	0.012	<0.005	0.019		<0.005	(i)	<0.02	0.0190	
Cadmium	0.001	0.001	0.001		<0.005	(i)	0.01	0.0010	0.005
Calcium	276	116	330	70		70	0	330	(j)
Chromium	0.022	0.006	0.045	<0.05	0.065	0.01	0.03	0.0450	
Copper	0.008	0.004	0.013	<0.05	1[k]	0.003	0.06	0.0132	0.015
Iron	0.05	0.01	0.08	0.05	1[k]	0.71	0.05	0.0806	0.3
pH	7.3-8.5	7.3	8.5	7.8	8.5-9.0	8.4	6.5-7.0	8.0	6.5-8.5
Lead	0.01	0.01	0.01		<0.1	0.005	0.05	0.0100	0.05
Magnesium	407	122	905	28			2300	911	
Manganese	0.02	0.01	0.04	0.05		0.24	0.06	0.0400	
Mercury	0.0001	0.0001	0.0002		0.007	(i)	<0.0002	0.0002	0.0001
Nickel	0.005	0.004	0.01	0.05	0.096	0.02	0.03	0.0101	0.1
Selenium	0.281	0.129	0.565		0.032	(i)	0.009	0.5646	0.025
Potassium	278	204	301	2.1			2.1		
Sodium	7150	4550	7600	15			2200	7595	
Thallium	0.15	<0.1	0.2			(i)	0.15		
Zinc	0.008	0.007	0.011	2.0	0.05	0.05	0.240	0.0126	1.0
Oil and grease	1.5	<1.0	1.9	<1	5	15	20	1.9093	<5
Vanadium				<0.001			<0.001		
Silver						(i)			0.00005
Sulfite							4800	1.17	

Note: See abbreviations and footnotes at end of table.

Table 3-45. Continuous-discharge stream water quality[a,b] (Sheet 2 of 2)

Abbreviations:
FGD = flue-gas desulfurization.
WQ = water quality.
gpm = gallons per minute.
FAC = Florida Administrative Code.
TRC = total residual chlorine.

[a] Adapted from TECO (1981a).

[b] All concentrations in milligrams per liter unless otherwise indicated.

[c] Data were obtained from the following five sources, as noted in the U.S. Environmental Protection Agency NPDES permit application:
1. Water-quality data for the period April 29, 1973, through May 5, 1973, Stone & Webster Engineering Corporation.
2. Water-quality data for the period October 15, 1979, through December 3, 1979, Tampa Electric Company Central Testing Laboratory.
3. Water-quality data for June 26, 1979, Thorton Laboratories, Inc.
4. TECO (1980d).

[d] Analytical results for city water taken at Sample Point 13 on April 29, 1973 (24-hour composite values).

[e] Values reflect effluent concentrations from bottom-ash pond at plant burning southern Illinois coal. Treatability of Ash Settling Pond Effluents, Utility Water Act Group (1979).

[f] Values reflect estimated concentrations after treatment. Values estimated for "combined effluent" concentrations are based on before-treatment concentrations for conservative estimates.

[g] Combined effluents were calculated from maximum intake-water concentrations.

[h] Standards for elemental phosphorus.

[i] Less than minimum quantifiable concentration from Treatability of Ash Settling Pond Effluents, Utility Water Act Group (1979).

[j] The chromium standard is 1.0 milligram per liter total and 0.05 milligram per liter after reasonable mixing of discharge in receiving water.

[k] Maximum value. Estimated values are 0.04 milligram per liter for copper and 0.001 milligram per liter for iron.

Table 3-46. Big Bend Station intake-water-quality data for three sampling periods[a,b]

	Sampling data												
	1970-1974				1980				1980-1981				
Element	Min.	Max.	Avg.	Number of samples	Min.	Max.	Avg.	Number of samples	Min.	Max.	Avg.	Number of samples	Florida water-quality standards
Arsenic	—	—	—	—	0.124[c]	0.293[c]	0.204[c]	3	0.002	0.232	0.048	47	0.05
Cadmium	0.005	0.110	0.033	10	0.001	0.001	0.001	12	0.005	0.055	0.008	47	0.005
Chromium	0.001	0.430	0.054	15	0.006	0.045	0.022	12	0.05	0.075	0.052	47	0.05
Copper	0.0001	0.1	0.026	15	0.004	0.013	0.008	12	0.044	0.098	0.064	47	0.015
Iron	0.002	0.9	0.168	15	0.01	0.08	0.05	12	0.03	1.014	0.237	47	0.3
Lead	0.001	0.3	0.068	5	0.01	0.01	0.01	12	0.1	0.1	0.1	47	0.05
Mercury	0.00008	0.003	0.0012	5	0.0001	0.0002	0.0001	12	0.002	0.054	0.0065	47	0.0001
Nickel	0.001	0.62	0.1	15	0.004	0.01	0.005	12	0.04	0.18	0.05	47	0.1
Selenium	—	—	—	—	0.129[c]	0.565[c]	0.281[c]	3	0.004	0.112	0.036	47	0.025
Zinc	0.001	0.35	0.038	14	0.007	0.011	0.008	12	0.005	0.302	0.117	47	1.0

[a] Adapted from TECO (1981c).
[b] All data in milligrams per liter.
[c] October-December 1979 water-quality data.

Table 3-47. Big Bend Station intake-water-quality data, 1980-1981[a]

Element	Minimum value is above FWQS	Average value is above FWQS	Maximum value is above FWQS
Arsenic			X
Cadmium		X	X
Chromium		X	X
Copper	X	X	X
Iron			X
Lead	X[b]	X[b]	X[b]
Mercury	X	X	X
Nickel			X
Selenium		X	X
Zinc			

Abbreviation: FWQS = Federal water-quality standard.

[a] Adapted from TECO (1981).
[b] Limit of detection was greater than FWQS.

Table 3-48. Big Bend Unit 4 discharge-water quality following treatment to meet State and Federal effluent limitations[a],[b]

Element	Boiler blowdown[c]	FGD blowdown	Bottom-ash blowdown	Intake circulating water (maximum)[d]	Detectable effluent water quality at combined discharge	Florida water-quality standard
Arsenic	0.193	0.250	0.02	0.232	0.232	0.05
Cadmium	<0.005	0.01	0.005	<0.055	0.055	0.005
Chromium	0.065	0.03	0.01	0.075	0.075	0.05
Copper	1	0.06	0.003	0.098	0.098	0.015
Iron	1	0.05	0.71	1.014	1.014	0.3
Lead	<0.1	0.05	0.005	0.1	0.1	0.05
Mercury	0.007	<0.0002	<0.0002	0.0540	0.0540	0.0001
Nickel	0.096	0.03	0.02	0.180	0.180	0.1
Selenium	0.032	0.009	<0.004	0.112	0.112	0.025
Zinc	0.05	0.24	0.05	0.302	0.302	1.0

[a] Adapted from TECO (1981).

[b] All data in milligrams per liter.

[c] No treatment required to meet effluent standards.

[d] From 1981 data.

Table 3-49. Big Bend Unit 4 discharge-water quality following treatment to meet State and Federal effluent limitations and reverse-osmosis treatment of the blowdown streams[a,b]

Element	Combined blowdown streams after heavy-metal treatment	Intake circulating water (maximum)[c]	Combined detectable water quality at discharge (heavy-metal removal)	Combined detectable water quality at discharge (no heavy-metal removal)	Florida water-quality standard
Arsenic	0.05	0.232	0.232	0.232	0.05
Cadmium	0.005	0.055	0.055	0.055	0.005
Chromium	0.045	0.075	0.075	0.075	0.05
Copper	0.015	0.098	0.098	0.098	0.015
Iron	0.3	1.014	1.014	1.014	0.3
Lead	0.038	0.1	0.1	0.1	0.05
Mercury	0.0001	0.054	0.054	0.054	0.0001
Nickel	0.037	0.180	0.180	0.180	0.1
Selenium	0.011	0.112	0.112	0.112	0.025
Zinc	0.012	0.302	0.302	0.302	1.0

[a] From TECO (1981c).

[b] All data in milligrams per liter.

[c] From 1981 data.

Table 3-50. Dilution factors calculated for chlorine discharged from Big Bend Unit 4[a]

Effective dilution factor	Distance (feet)	Area[b]	
		Square feet	Acres
2	190.8	46,934.8	1.1
3	302.4	74,389.9	1.7
4	381.6	93,869.6	2.2
5	443.0	108,979.3	2.5
6	493.2	121,324.8	2.8
7	535.6	131,762.7	3.0
8	572.4	140,804.5	3.2
9	604.8	148,779.9	3.4
10	633.8	155,914.1	3.6
11	660.0	162,367.8	3.7
12	684.0	168,259.6	3.9
13	706.0	173,679.5	4.0
14	726.4	178,697.5	4.1
15	745.4	183,369.2	4.2
16	753.2	187,739.3	4.3
17	779.9	191,844.3	4.4
18	795.6	195,714.7	4.5
19	810.5	199,375.7	4.6
20	824.6	202,848.9	4.7

[a] Adapted from TECO (1980b).

[b] Based on a channel width of 246 feet.

Table 3-51. Tolerance of selected species to continuously chlorinated effluent[a]

Species	Form	96-hour LC_{50} (mg/ℓ)	Reference
Crassostrea virginica (Ostreidae) Eastern oyster	Juvenile Juvenile	0.023 $\geq$1.500	Roberts et al. (1975) Bongers et al. (1977)
Callinectes sapidus (Portunidae) Blue crab		0.1	Mattice and Zittel (1976)
Brevoortia tyrannus (Clupeidae) Atlantic menhaden	Juvenile	$0.09 < LC_{50} < 0.223$	Bongers et al. (1977)
Leiostomus xanthurus (Sciaenidae) Spot	Juvenile	$0.09 < LC_{50} < 0.223$	Bongers et al. (1977)
Menidia menidia (Atherinidae) Atlantic silverside	Larvae/juvenile	0.037	Roberts et al. (1975)

Abbreviations:

LC_{50} = lethal concentration for 50 percent of the test organisms after 96 hours.

mg/ℓ = milligrams per liter.

[a]Adapted from TECO (1981a).

Table 3-52. Temperatures of cooling-tower makeup water and blowdown-discharge water for Big Bend Unit 4[a]

Season/month	Ambient water temperature (°F)			Blowdown discharge temperature (°F)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
Winter						
January	66	54	59.6	80.4	56.5	69.3
February	63	50	57.9	80.9	57.5	69.4
Summer						
March	75	58	66.4	84.0	60.0	72.3
April	85	67	76.8	89.5	63.5	75.3
May	85	73	80.0	93.9	67.5	79.9
June	89	81	85.6	96.5	73.4	85.5
July	94	82	87.2	97.4	76.4	87.3
August	90	79	86.1	98.4	77.5	88.3
September	88	82	85.4	96.5	75.1	85.5
October	84	71	76.9	92.0	68.5	79.5
Winter						
November	79	67	73.4	85.1	60.8	73.4
December	77	62	68.7	81.2	57.1	70.0

[a] Adapted from TECO (1981b).

Table 3-53. Quality of cooling-tower makeup water and blowdown discharge water for potential sources of makeup water for Big Bend Unit 4[a,b]

Parameter	Bay water				Ground water[c]				Tampa sewage treatment plant effluent			
	Intake		Discharge		Intake		Discharge		Intake		Discharge	
	average	Average	Minimum	Maximum	average	Average	Minimum	Maximum	average	Average	Minimum	Maximum
pH	7.3-8.5	NA	7.3	8.5	7.4-8.2	NA	7.4	8.2	6.9-7.1	NA	6.9	7.1
Total suspended solids	24.2	36.3	24.5	66.5	ND	ND	ND	ND	11.5	17.3	ND	ND
Aluminum	0.22	0.33	0.15	0.57	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	0.20	0.31	0.19	0.44	ND	ND	ND	ND	0.003	0.005	ND	ND
Cadmium	0.028	0.042	0.008	0.113	ND	ND	ND	ND	0.001	0.002	ND	ND
Chromium	0.022	0.033	0.009	0.068	0.02	0.03	ND	ND	0.012	0.018	ND	ND
Copper	0.008	0.012	0.006	0.02	0.01	0.015	ND	ND	0.002	0.003	ND	ND
Lead	0.01	0.02	0.02	0.02	ND	ND	ND	ND	0.03	0.05	ND	ND
Mercury	0.0001	0.0002	0.0002	0.0003	ND	ND	ND	ND	0.0051	0.0077	ND	ND
Nickel	0.005	0.008	0.006	0.02	ND	ND	ND	ND	0.023	0.035	ND	ND
Zinc	0.008	0.012	0.011	0.017	0.26	0.39	ND	ND	0.04	0.06	ND	ND
Oil and grease	1.5	2.3	<1.0	2.9	ND	ND	ND	ND	ND	ND	ND	ND
Chlorine, total residual	NA	0.2	<0.01	0.5	NA	0.2	<0.03	0.5	NA	0.2	<0.03	0.5
Selenium	0.28	0.42	0.19	0.85	ND	ND	ND	ND	ND	ND	ND	ND
Beryllium	0.012	0.018	0.008	0.029	ND	ND	ND	ND	ND	ND	ND	ND

Abbreviations:
NA = not applicable.
ND = no data.

[a] Adapted from TECO (1981c).

[b] All except pH data in milligrams per liter.

[c] Data from Wilson (1977) and Wilson et al. (1973).

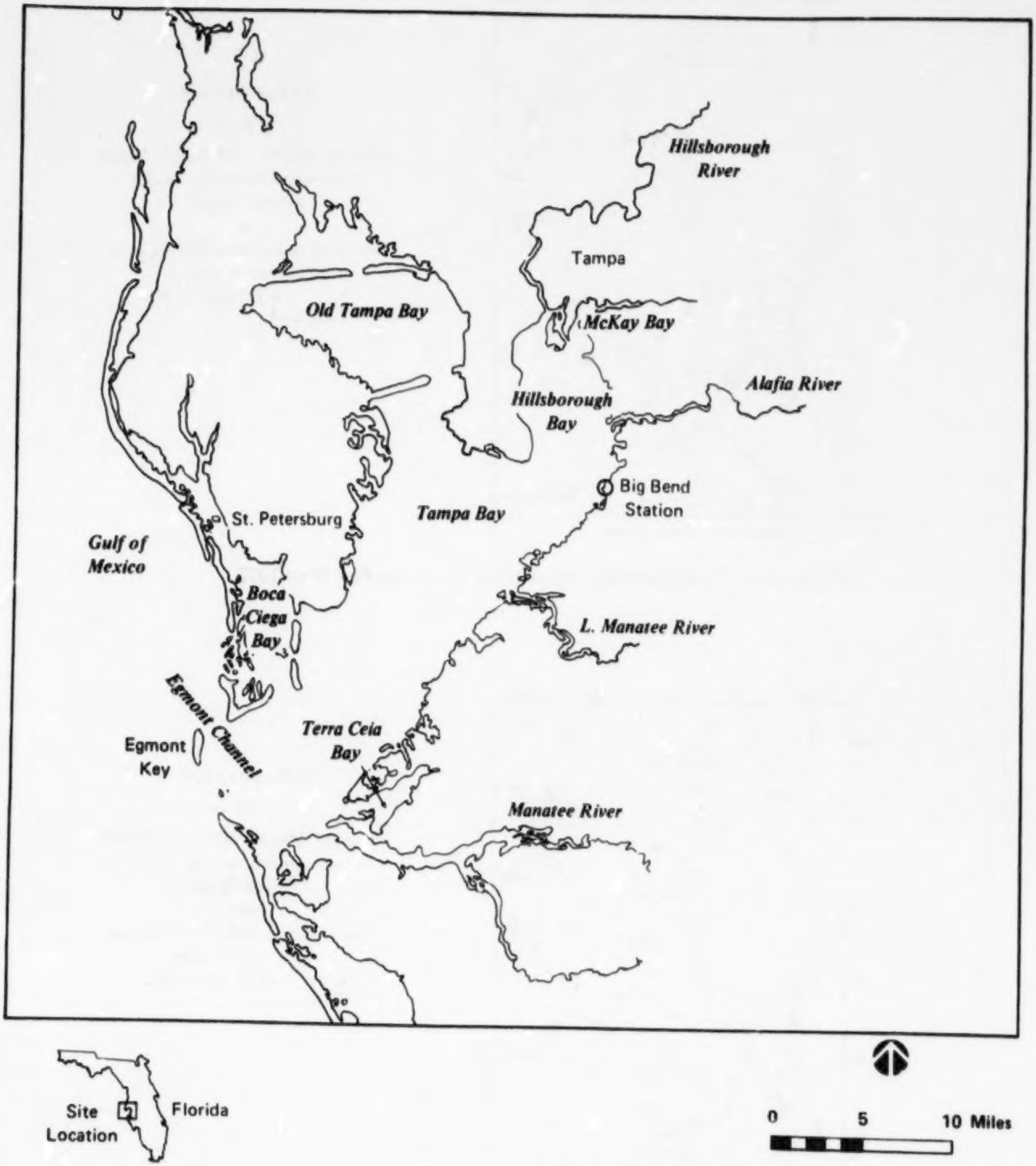
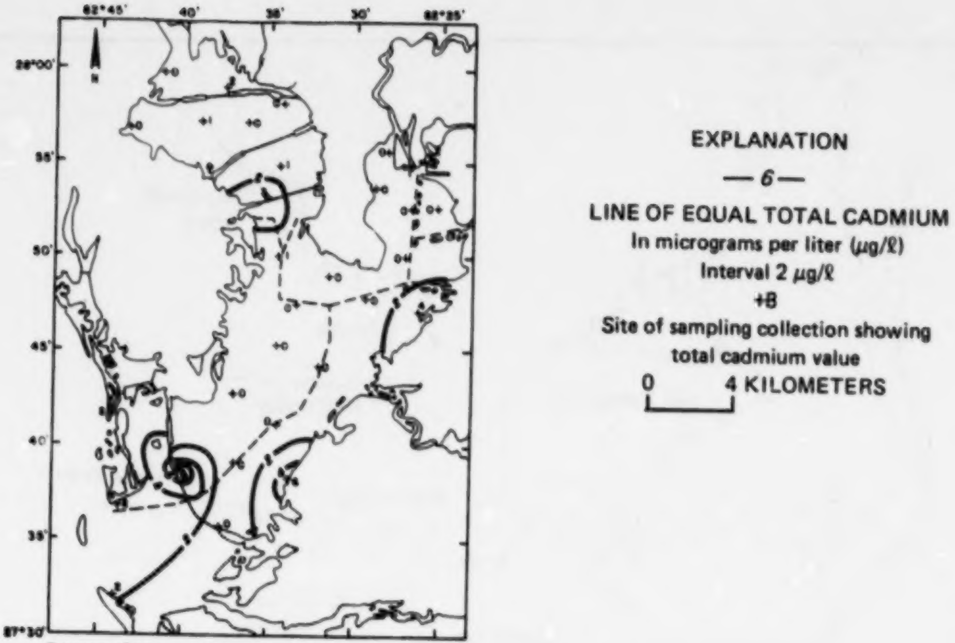
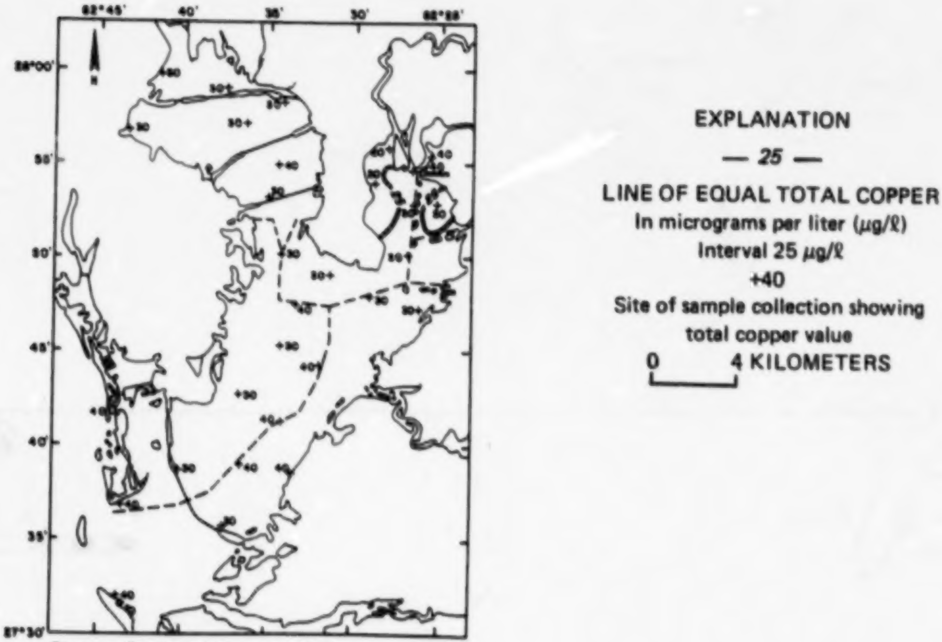

Hillsborough River
Tampa
Old Tampa Bay
McKay Bay
Alafia River
Hillsborough Bay
Big Bend Station
St. Petersburg
Tampa Bay
Gulf of Mexico
Boca Ciega Bay
L. Manatee River
Egmont Channel
Egmont Key
Terra Ceia Bay
Manatee River
Site Location
Florida
0
5
10 Miles

Figure 3-10. The Tampa Bay system.


82°45'
40'
35'
30'
82°25'
28°00'
55'
50'
45'
40'
35'
27°30'
N
EXPLANATION
— 6 —
LINE OF EQUAL TOTAL CADMIUM
In micrograms per liter (μg/ℓ)
Interval 2 μg/ℓ
+8
Site of sampling collection showing
total cadmium value
0 4 KILOMETERS

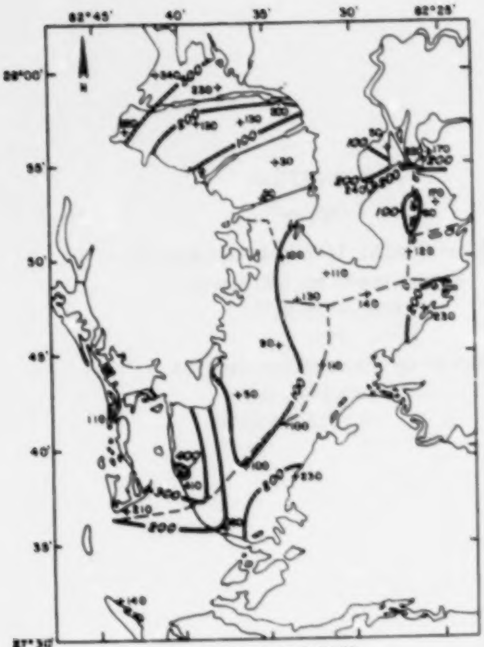
Source: Goetz and Goodwin (1980).

Figure 3-11. Total cadmium distribution in Tampa Bay, May 1973.


82°45'
40'
35'
30'
82°25'
28°00'
55'
50'
45'
40'
35'
27°30'
N
EXPLANATION
— 25 —
LINE OF EQUAL TOTAL COPPER
In micrograms per liter (μg/ℓ)
Interval 25 μg/ℓ
+40
Site of sample collection showing
total copper value
0 4 KILOMETERS

Source: Goetz and Goodwin (1980).

Figure 3-12. Total copper distribution in Tampa Bay, May 1973.


82°45'
40'
35'
30'
82°25'
28°00'
55'
50'
45'
40'
35'
27°30'
N

EXPLANATION

— *200* —

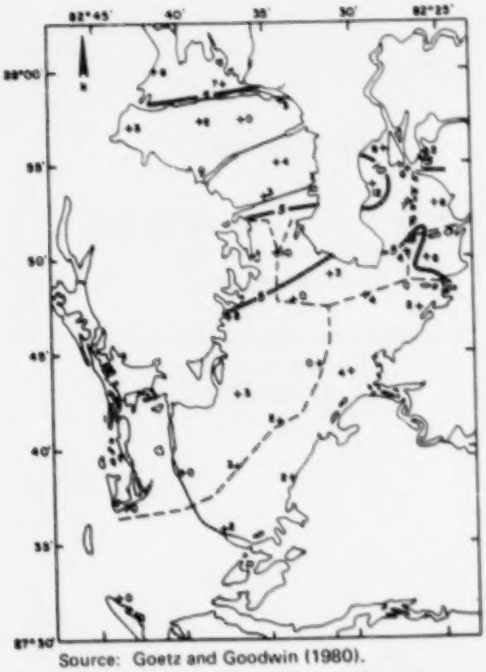
LINE OF EQUAL TOTAL IRON
In micrograms per liter (µg/ℓ)
Interval 100 µg/ℓ

+210
Site of sample collection showing
total iron value

0 4 KILOMETERS

Source: Goetz and Goodwin (1980).

Figure 3-13. Total iron distribution in Tampa Bay, May 1973.


82°45'
40'
35'
30'
82°25'
28°00'
55'
50'
45'
40'
35'
27°30'
N

EXPLANATION

— *5* —

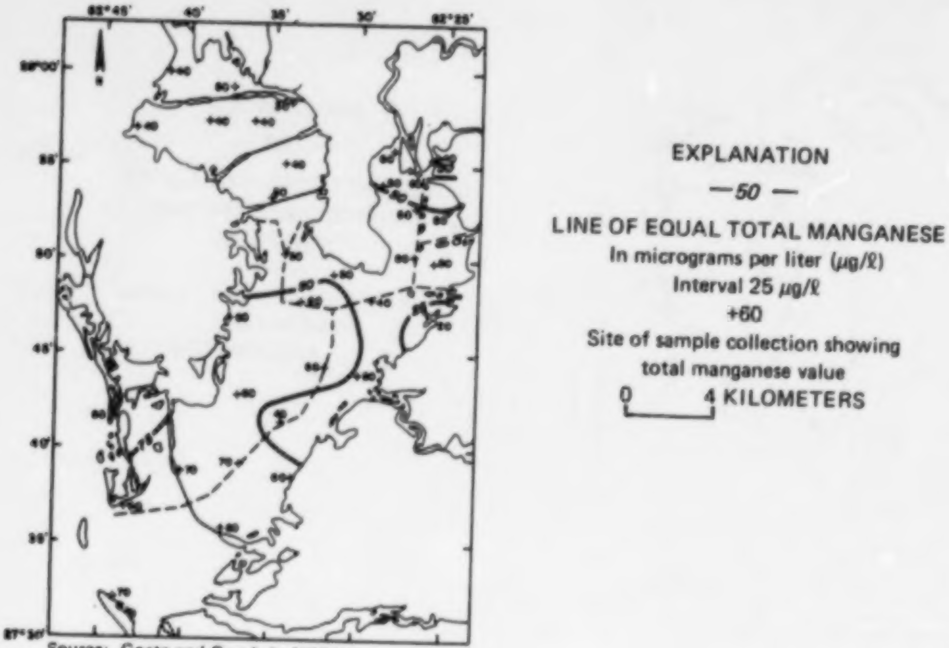
LINE OF EQUAL TOTAL LEAD
In micrograms per liter (µg/ℓ)
Interval 5 µg/ℓ

+3
Site of sample collection showing
total lead value

0 4 KILOMETERS

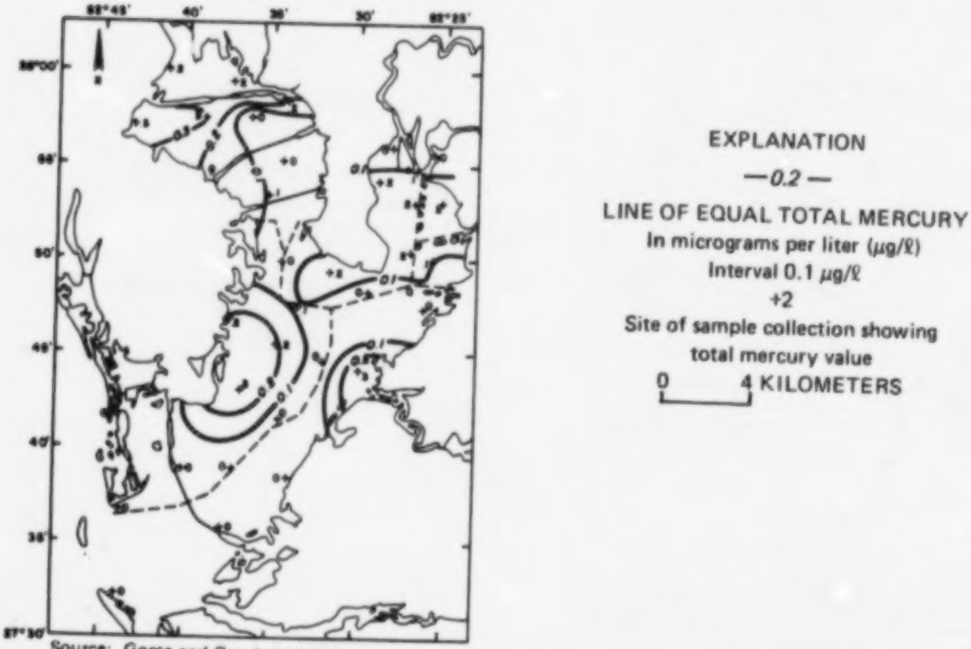
Source: Goetz and Goodwin (1980).

Figure 3-14. Total lead distribution in Tampa Bay, October 1975.


82°45'
40'
35'
30'
82°25'
28°00'
55'
50'
45'
40'
35'
27°30'
EXPLANATION
—50—
LINE OF EQUAL TOTAL MANGANESE
In micrograms per liter (µg/ℓ)
Interval 25 µg/ℓ
+60
Site of sample collection showing
total manganese value
0 4 KILOMETERS

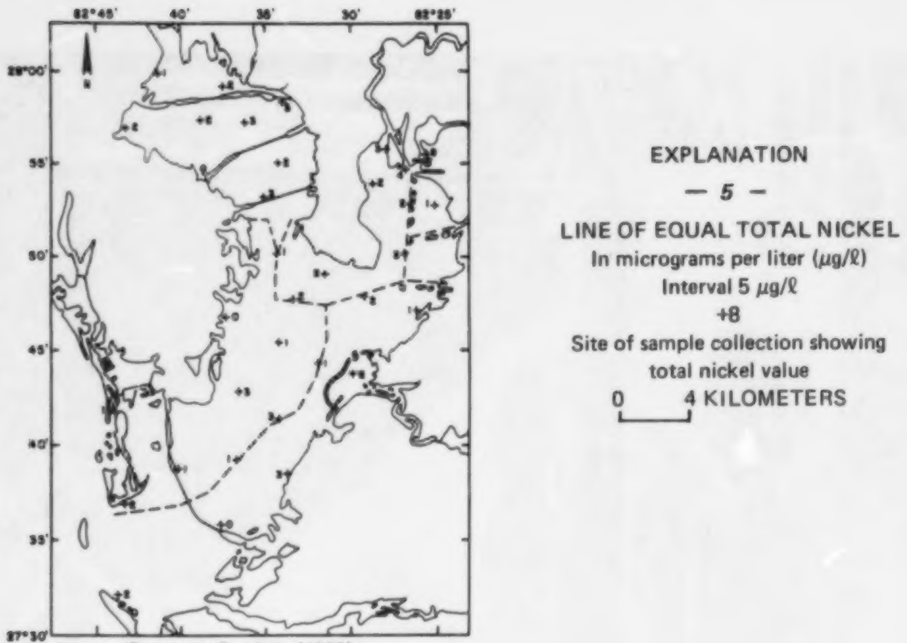
Source: Goetz and Goodwin (1980).

Figure 3-15. Total manganese distribution in Tampa Bay, October 1975.


82°45'
40'
35'
30'
82°25'
28°00'
55'
50'
45'
40'
35'
27°30'
EXPLANATION
—0.2—
LINE OF EQUAL TOTAL MERCURY
In micrograms per liter (µg/ℓ)
Interval 0.1 µg/ℓ
+2
Site of sample collection showing
total mercury value
0 4 KILOMETERS

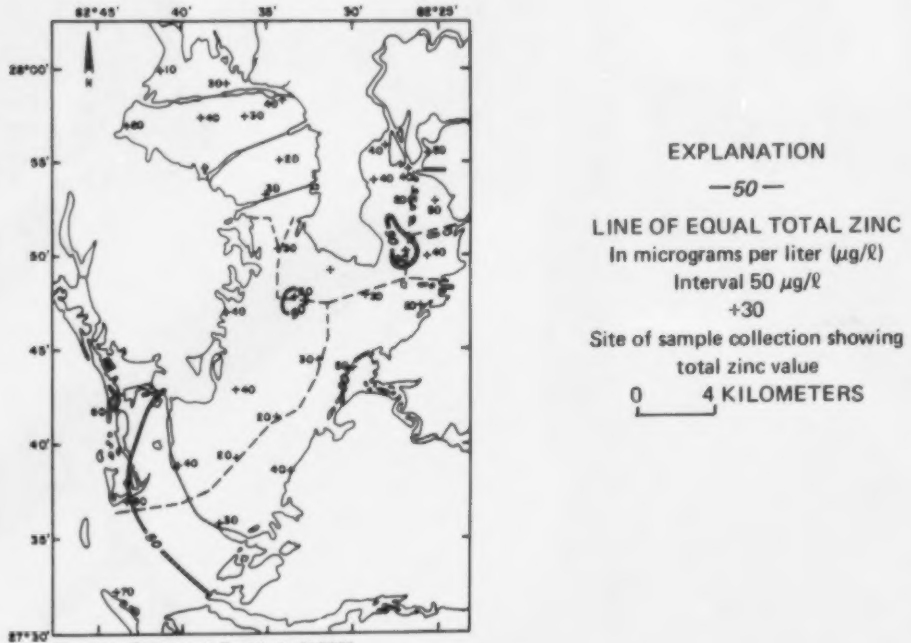
Source: Goetz and Goodwin (1980).

Figure 3-16. Total mercury distribution in Tampa Bay, October 1975.


82°45'
40'
35'
30'
82°25'
28°00'
55'
50'
45'
40'
35'
27°30'
N
EXPLANATION
— 5 —
LINE OF EQUAL TOTAL NICKEL
In micrograms per liter (μg/ℓ)
Interval 5 μg/ℓ
+8
Site of sample collection showing
total nickel value
0 4 KILOMETERS

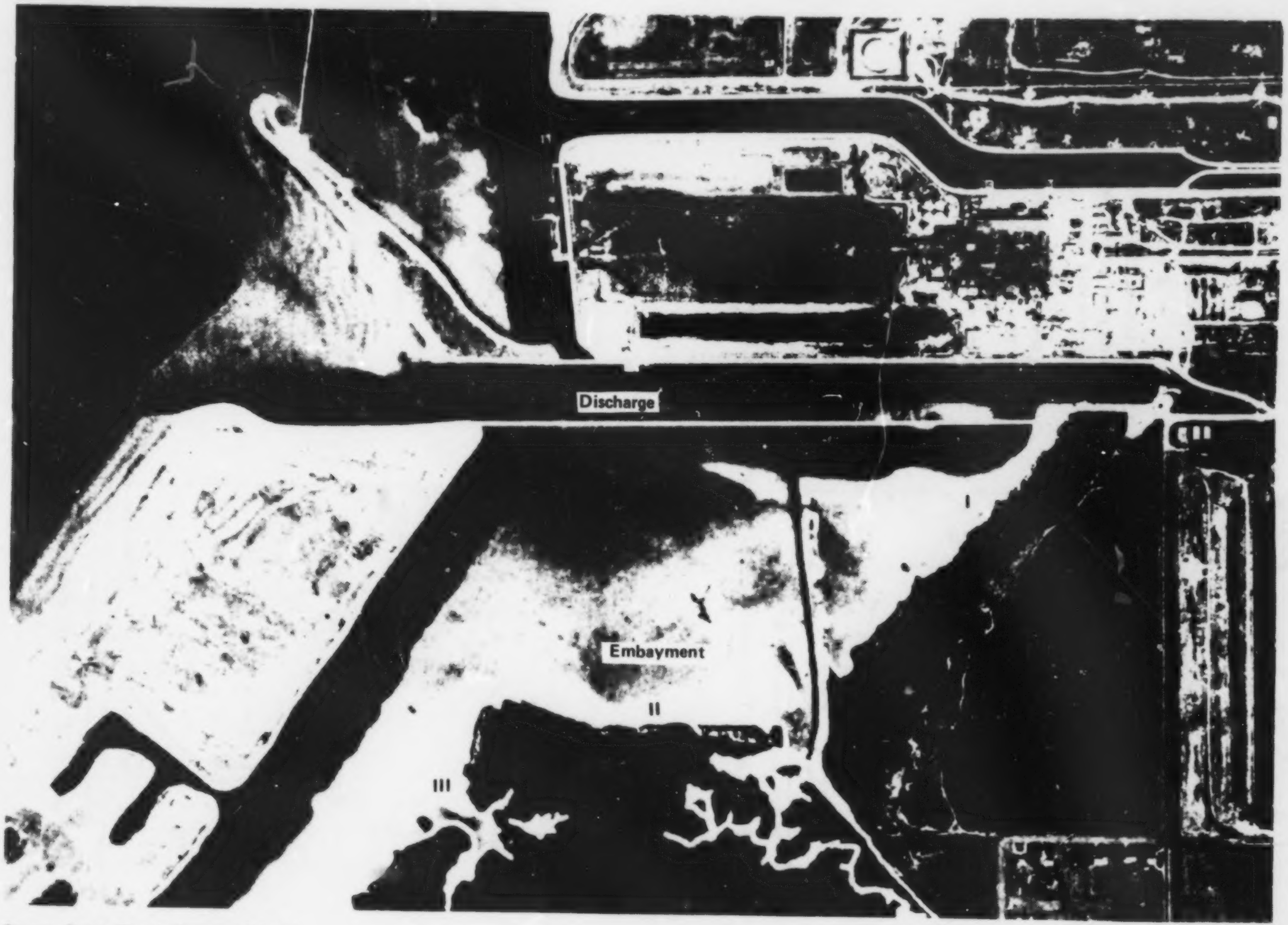
Source: Goetz and Goodwin (1980).

Figure 3-17. Total nickel distribution in Tampa Bay, May 1973.


82°45'
40'
35'
30'
82°25'
28°00'
55'
50'
45'
40'
35'
27°30'
N
EXPLANATION
—50—
LINE OF EQUAL TOTAL ZINC
In micrograms per liter (μg/ℓ)
Interval 50 μg/ℓ
+30
Site of sample collection showing
total zinc value
0 4 KILOMETERS

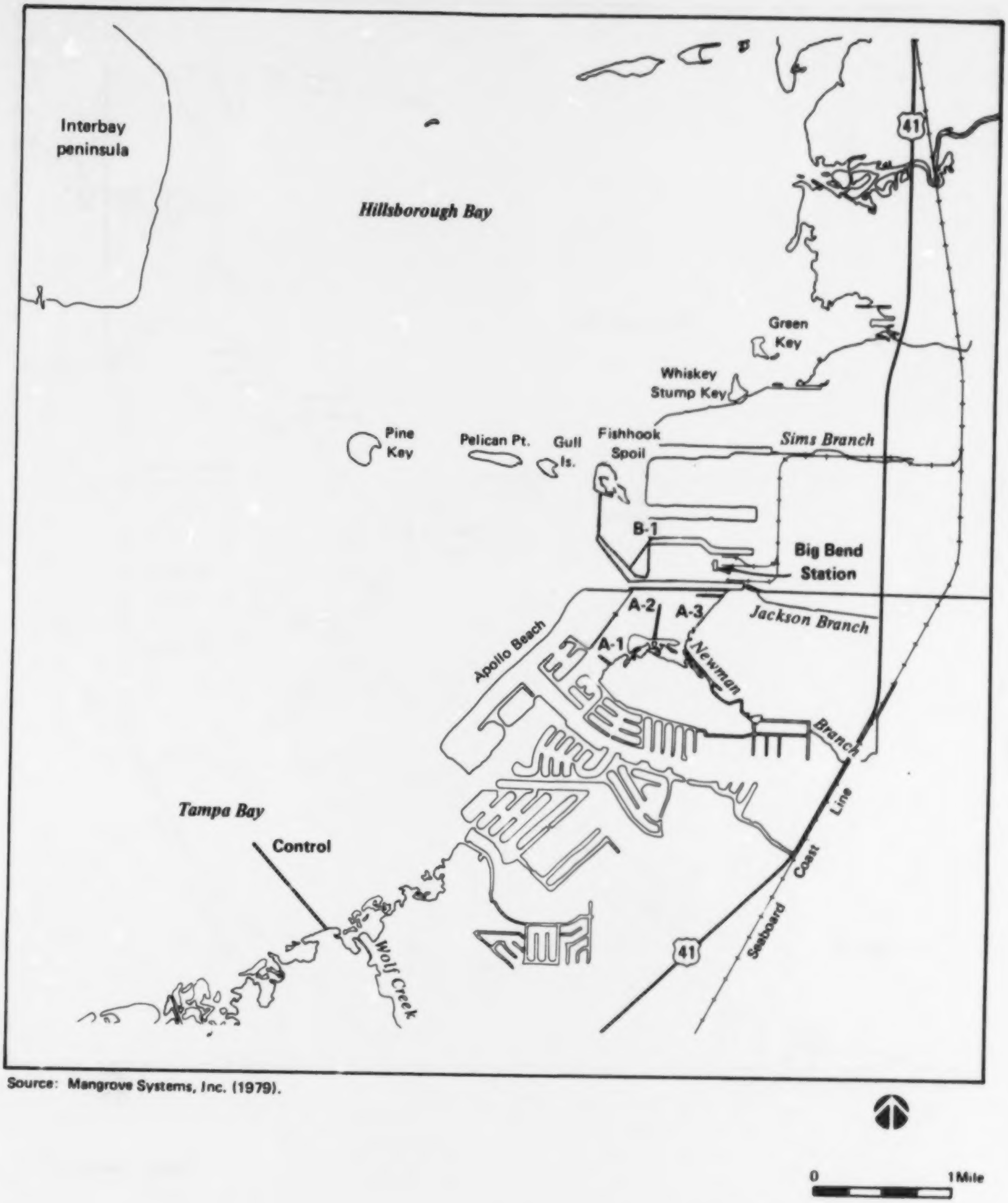
Source: Goetz and Goodwin (1980).

Figure 3-18. Total zinc distribution in Tampa Bay, October 1975.


Discharge
I
Embayment
II
III

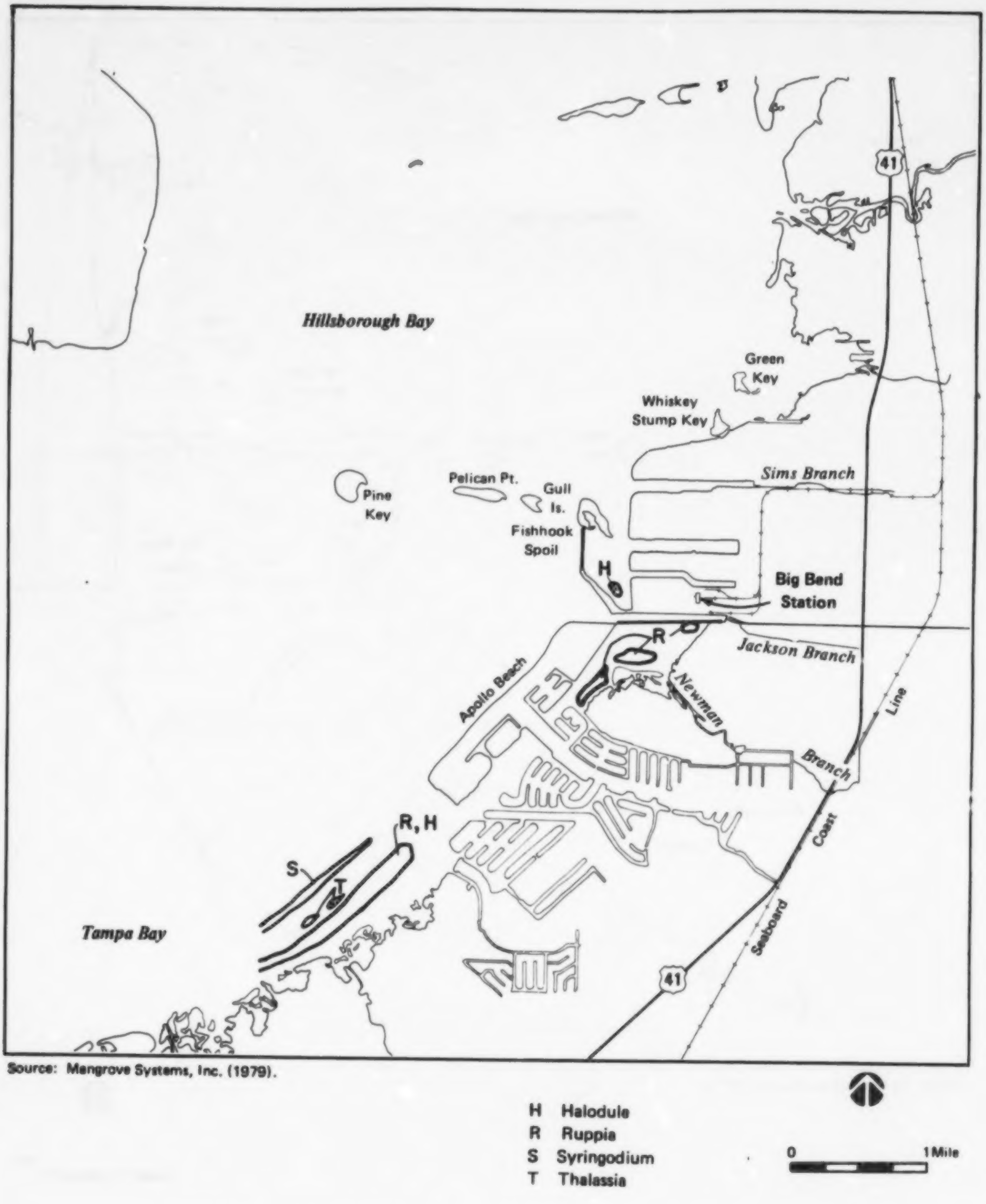
Source: Tampa Electric Company (1975a).

Figure 3-19. Sites of collection of benthic macrophytes within the embayment near the Big Bend power plant during 1975.


Interbay peninsula
Hillsborough Bay
41
Green Key
Whiskey Stump Key
Pine Key
Pelican Pt.
Gull Is.
Fishhook Spoil
Sims Branch
B-1
Big Bend Station
A-2
A-3
Jackson Branch
A-1
Apollo Beach
Newman Branch
Tampa Bay
Control
Line
Coast
Seaboard
41
Wolf Creek
0
1 Mile

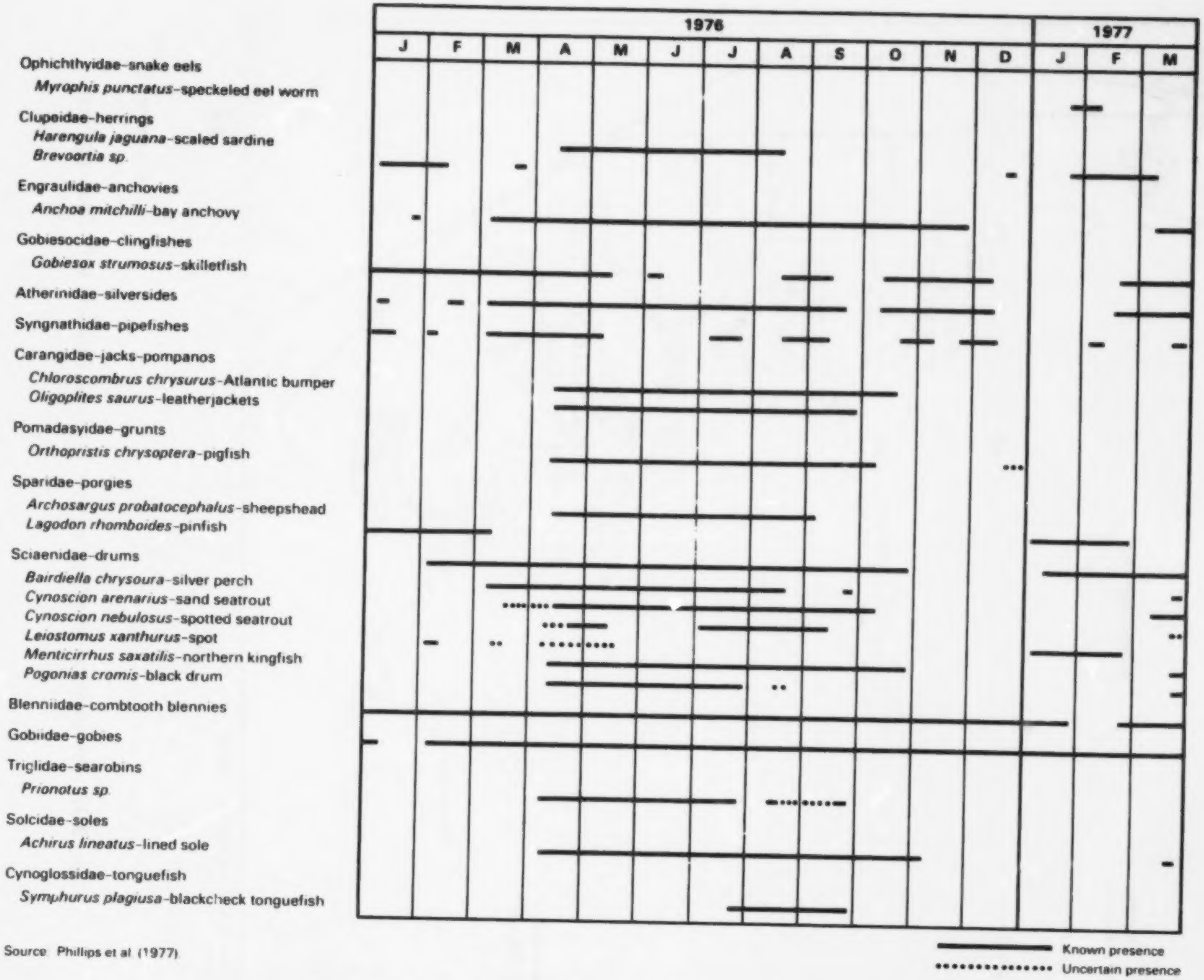
Source: Mangrove Systems, Inc. (1979).

Figure 3-20. Benthic-seagrass-sampling transects near Big Bend, 1977-1978.


Hillsborough Bay
41
Green Key
Whiskey Stump Key
Sims Branch
Pelican Pt.
Gull Is.
Pine Key
Fishhook Spoil
H
Big Bend Station
R
Jackson Branch
Apollo Beach
Newman Branch
Line
Coast
Seaboard
R, H
S
T
Tampa Bay
41
H Halodule
R Ruppia
S Syringodium
T Thalassia
0
1 Mile

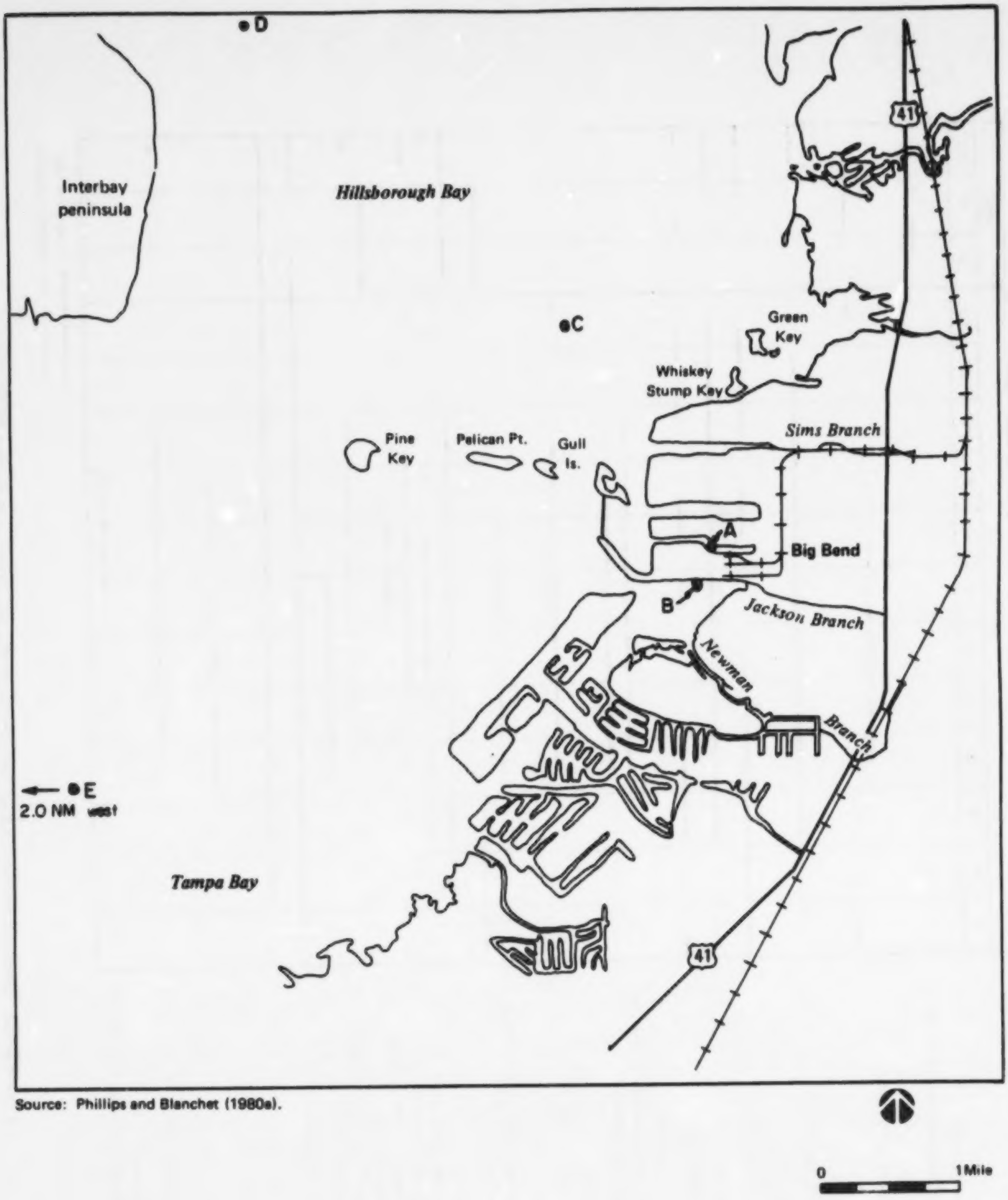
Source: Mangrove Systems, Inc. (1979).

Figure 3-21. Distribution of benthic seagrasses in a control area and in areas near the Big Bend power plant, 1977–1978.



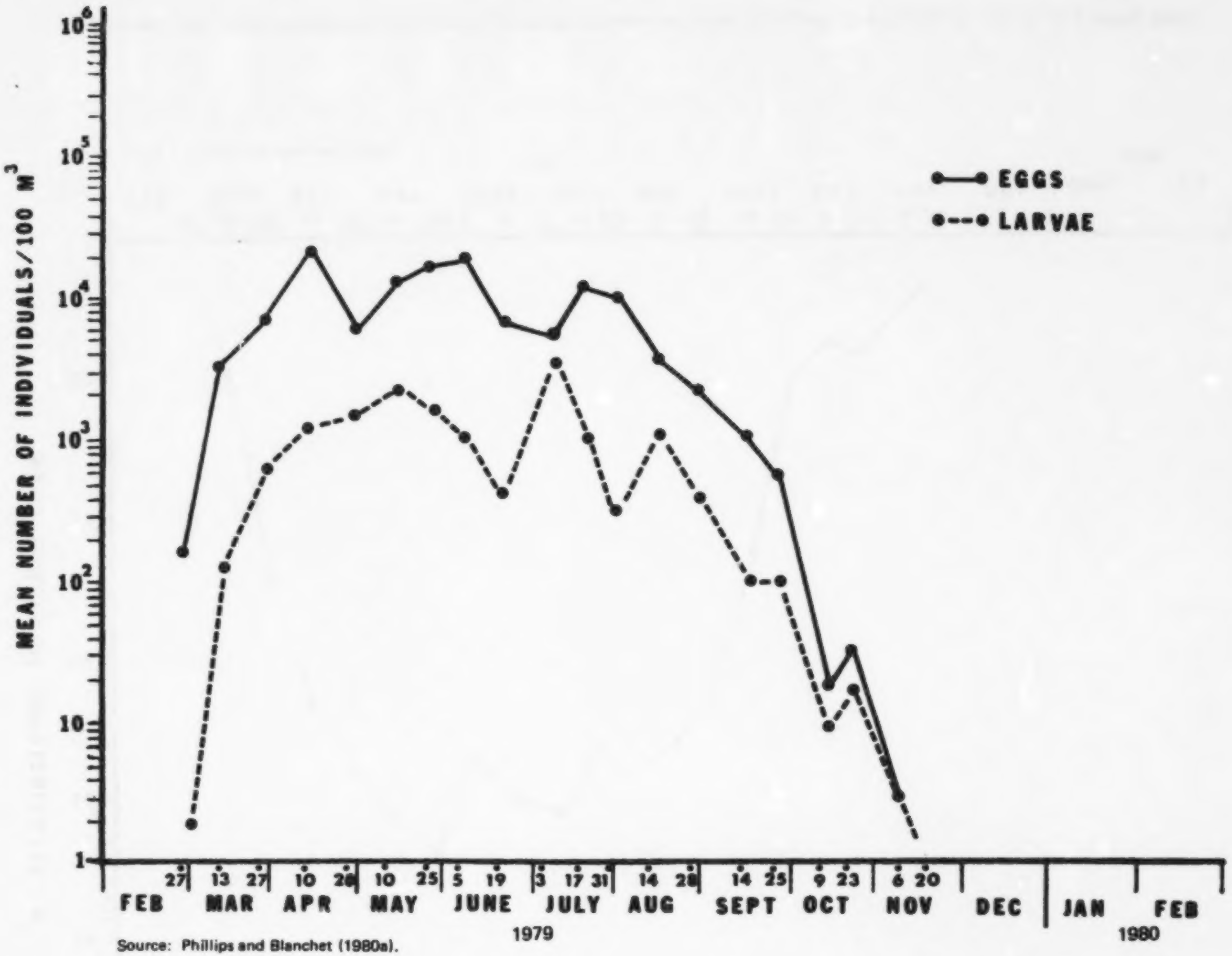
Source Phillips et al (1977)

Figure 3-22. Seasonal occurrence of fish larvae in the Big Bend area during 1976-1977.


D
Interbay peninsula
Hillsborough Bay
C
Green Key
Whiskey Stump Key
41
Sims Branch
Pine Key
Pelican Pt.
Gull Is.
A
Big Bend
B
Jackson Branch
Newman Branch
E
2.0 NM west
Tampa Bay
41
0
1 Mile

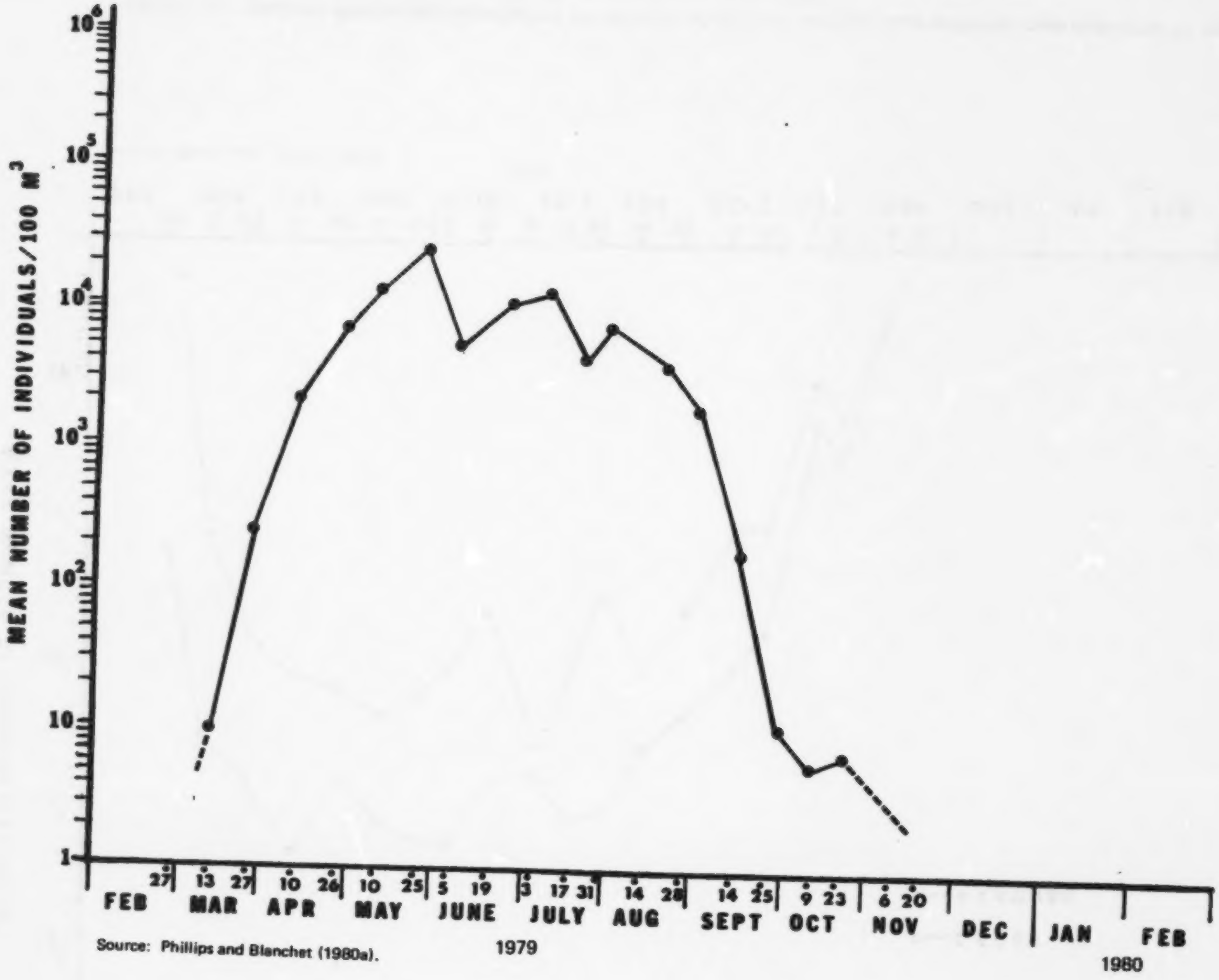
Source: Phillips and Blanchet (1980a).

Figure 3-23. Meroplankton-sampling stations at Big Bend, February 1979-February 1980.



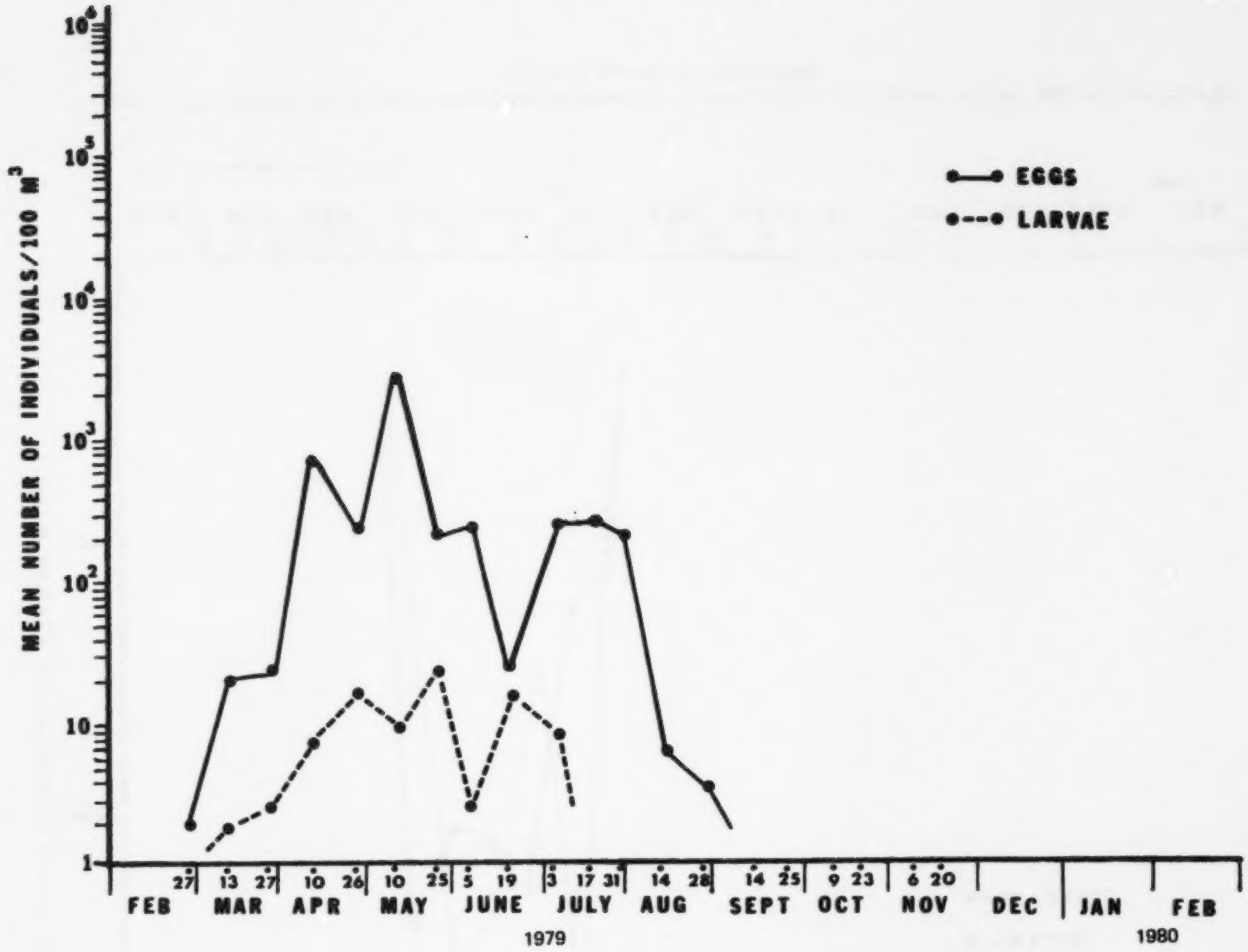
Source: Phillips and Blanchet (1980a).

Figure 3-24. Seasonal distribution (averages of all stations) of *Anchoa mitchilli* (bay anchovy) eggs and larvae in the Big Bend area during 1979–1980.



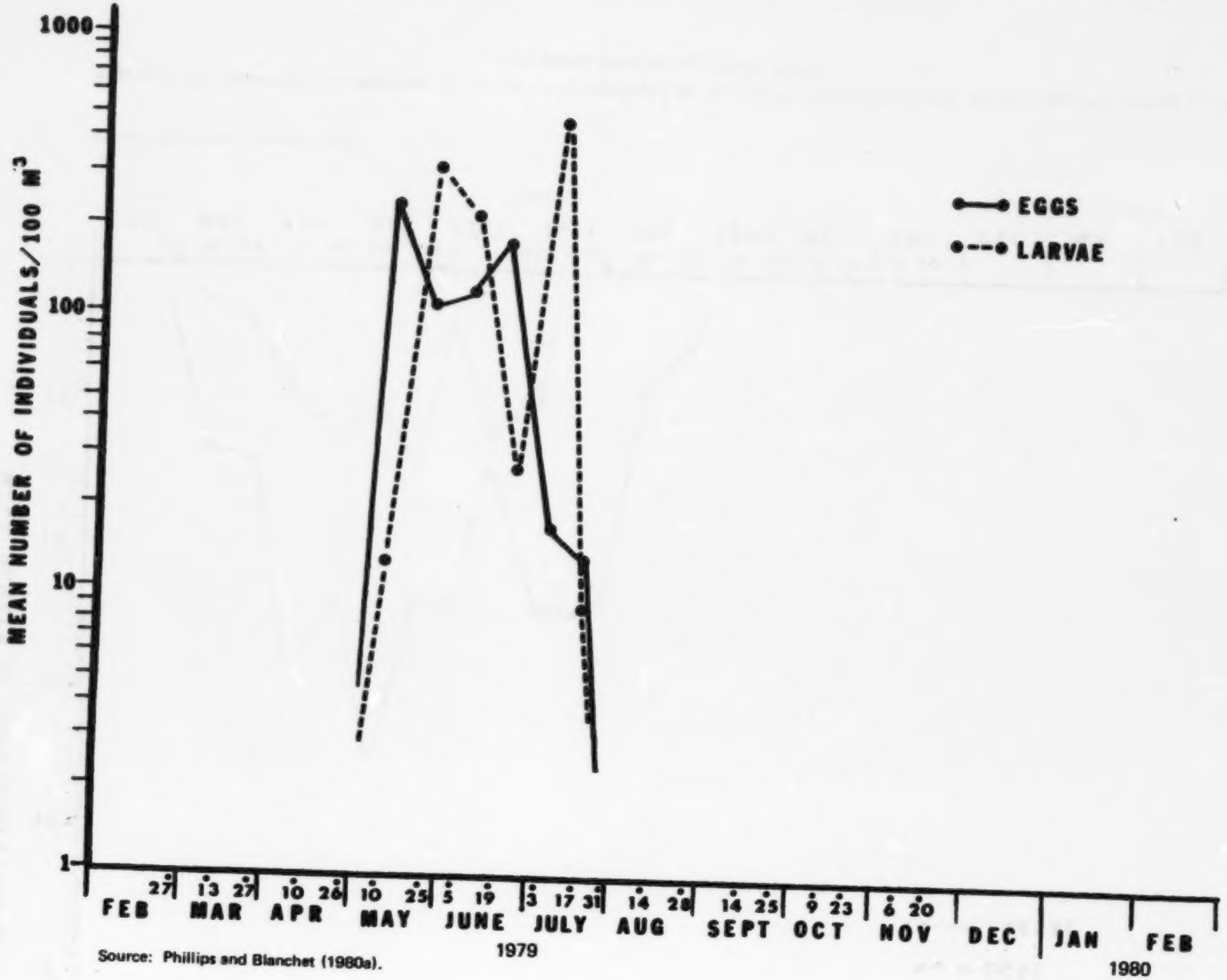
Source: Phillips and Blanchet (1980a).

Figure 3-25. Seasonal distribution (averages of all stations) of sciaenid eggs in the Big Bend area during 1979-1980.



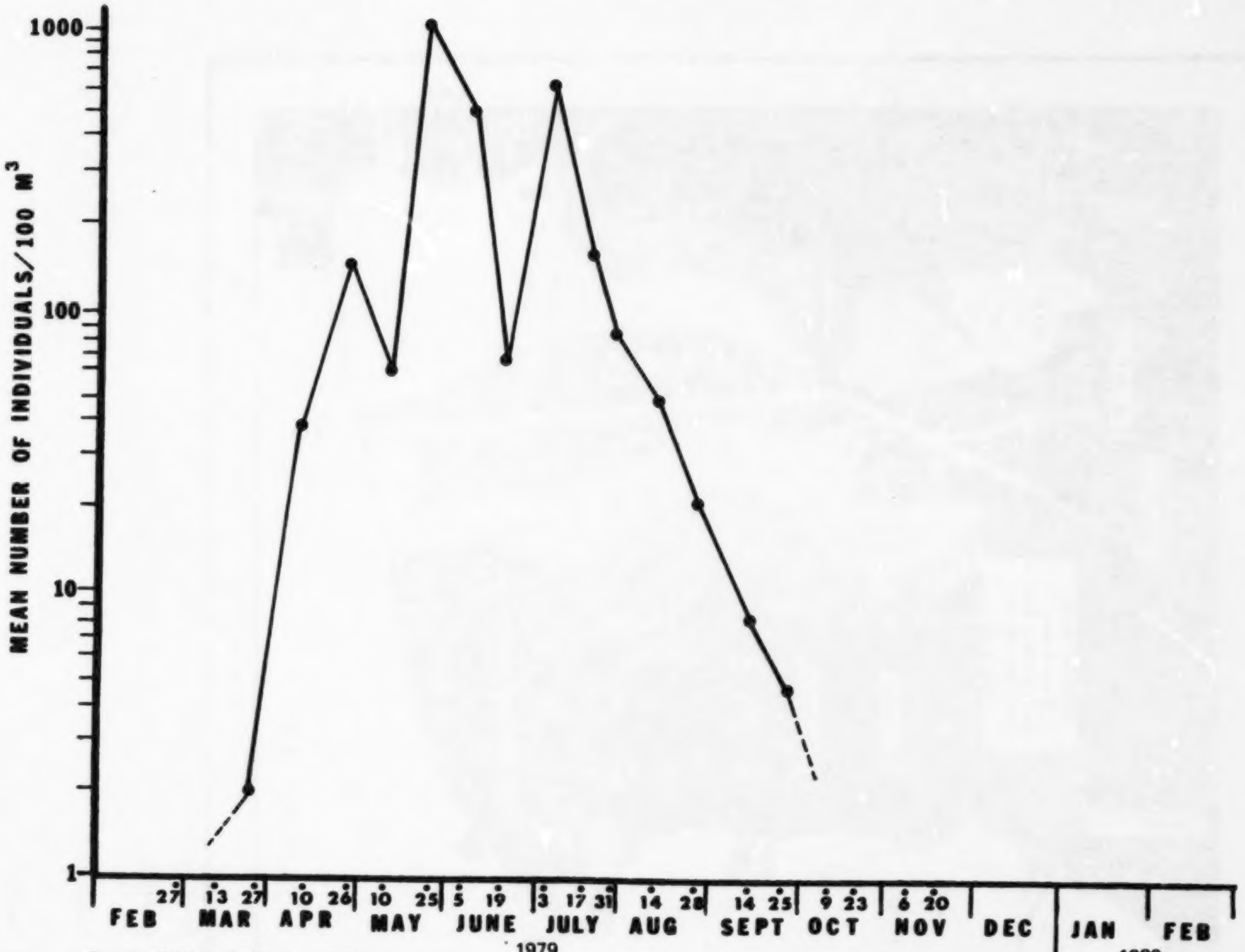
Source: Phillips and Blanchet (1980a).

Figure 3-26. Seasonal distribution (averages of all stations) of *Bairdiella chrysoura* (silver perch) eggs and larvae in the Big Bend area during 1979-1980.



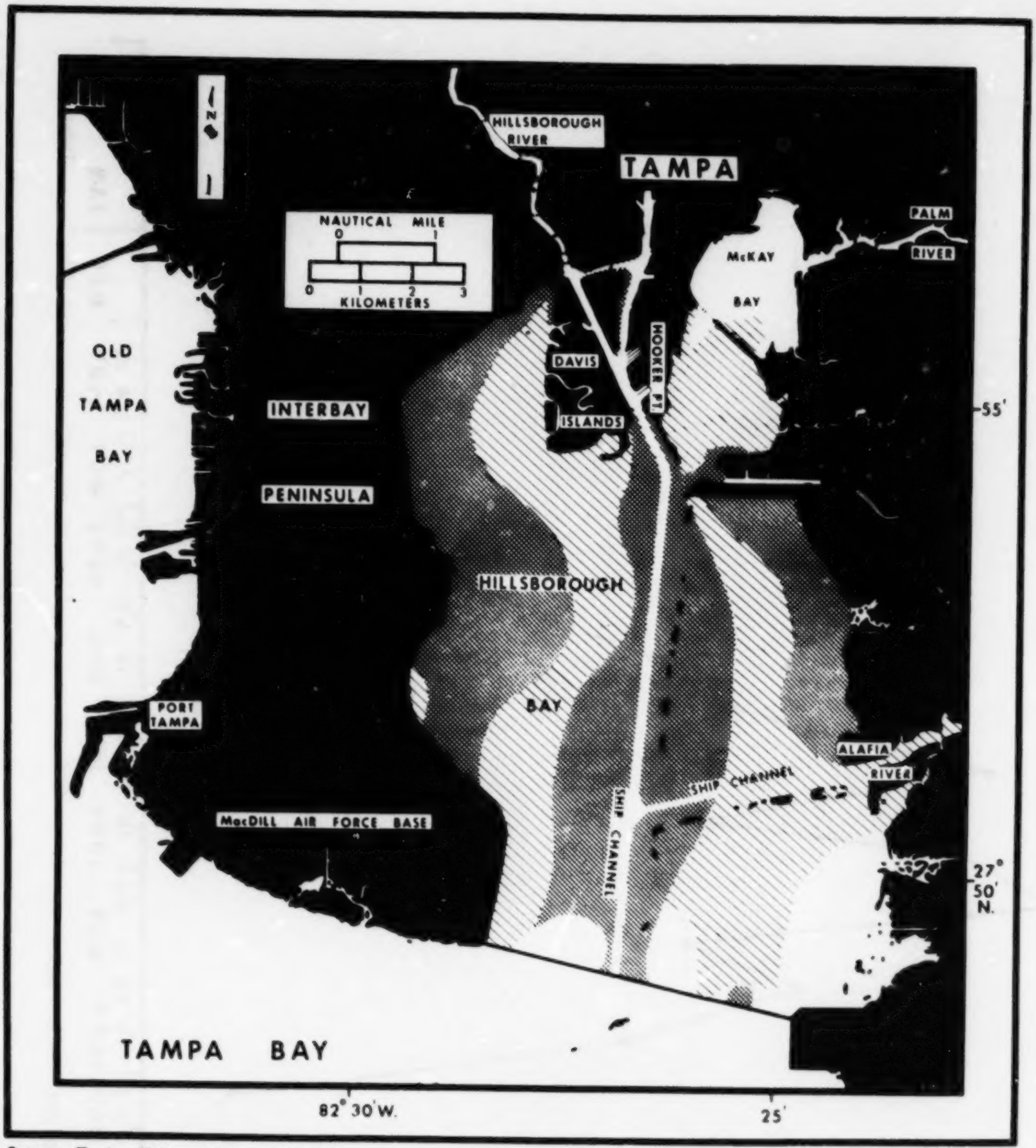
Source: Phillips and Blanchet (1980a).

Figure 3-27. Seasonal distribution (averages of all stations) of *Harengula jaguana* (scaled sardine) eggs and larvae in the Big Bend area during 1979-1980.



Source: Phillips and Blanchet (1980a).

Figure 3-28. Seasonal distribution (averages of all stations) of *Menippe mercenaria* (stone crab) zoeae in the Big Bend area during 1979-1980.


HILLSBOROUGH RIVER
TAMPA
N
NAUTICAL MILE
0 1
0 1 2 3
KILOMETERS
PALM RIVER
McKAY BAY
OLD TAMPA BAY
DAVIS ISLANDS
HOOKER PT
INTERBAY
PENINSULA
55'
HILLSBOROUGH
BAY
PORT TAMPA
ALAFIA RIVER
SHIP CHANNEL
SHIP CHANNEL
MacDILL AIR FORCE BASE
27°
50'
N.
TAMPA BAY
82° 30' W.
25'

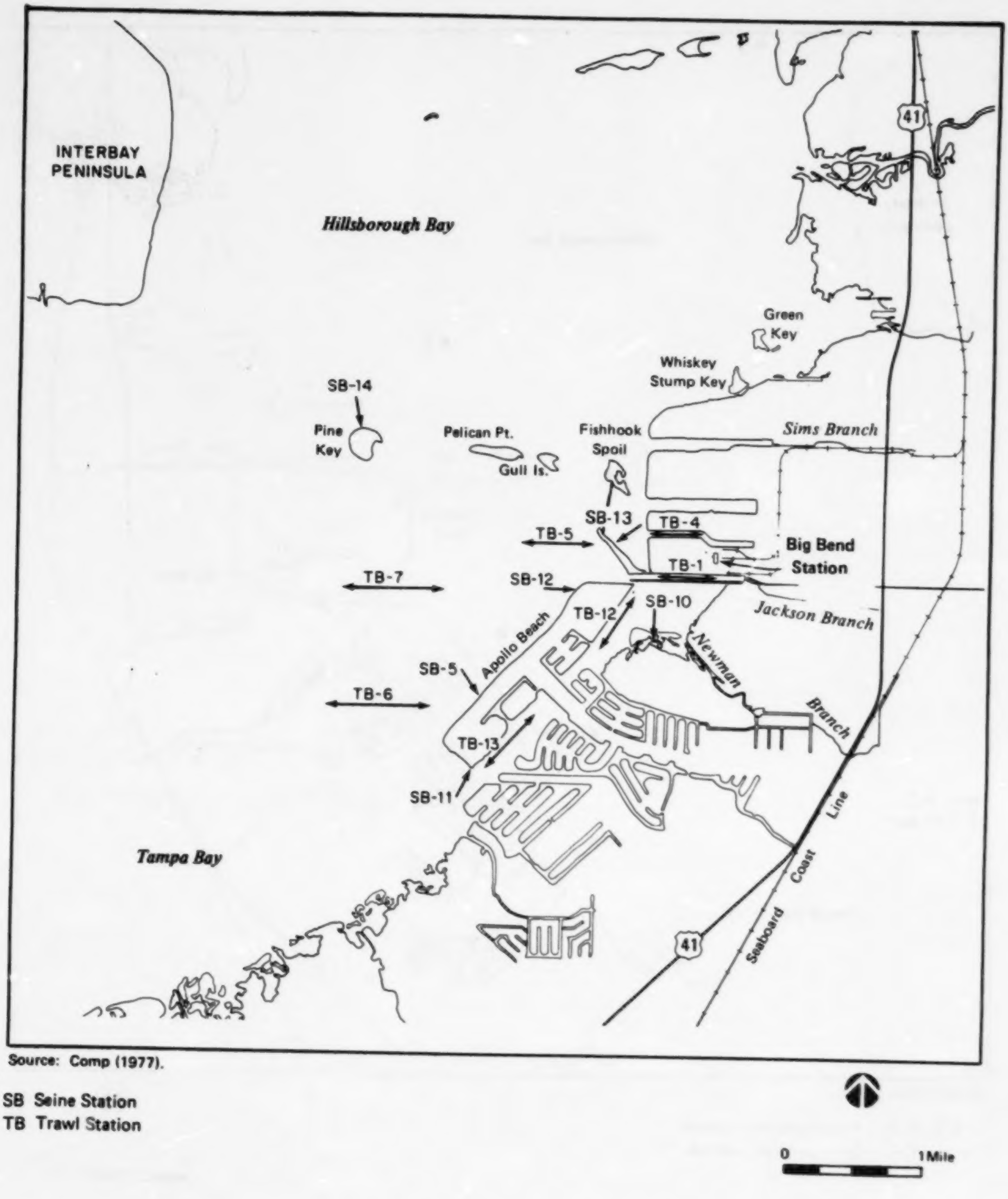
Source: Taylor, Hall, and Saloman (1971).

▒ Unhealthy

▨ Marginal

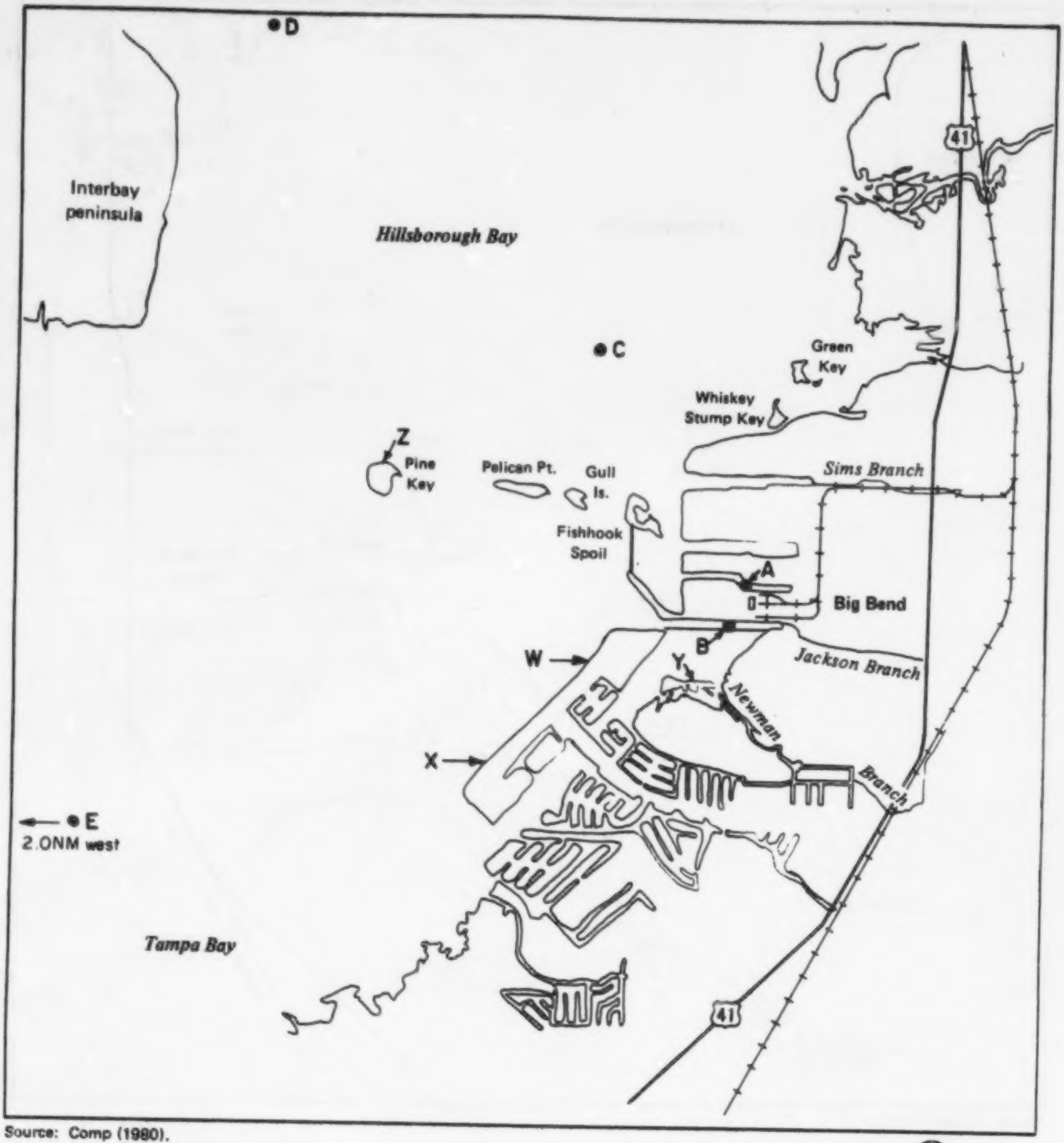
□ Healthy

Figure 3-29. Ecological zones in Hillsborough Bay based on the comparative density of benthic mollusks during August-September 1963.


INTERBAY PENINSULA
Hillsborough Bay
41
Green Key
Whiskey Stump Key
SB-14
Pine Key
Pelican Pt.
Gull Is.
Fishhook Spoil
Sims Branch
SB-13
TB-4
TB-5
Big Bend Station
TB-1
TB-7
SB-12
SB-10
TB-12
Jackson Branch
Apollo Beach
Newman Branch
SB-5
TB-6
TB-13
SB-11
Tampa Bay
Line
Coast
Seaboard
41
SB Seine Station
TB Trawl Station
0
1 Mile

Source: Comp (1977).

Figure 3-30. Seine and trawl sampling stations at Big Bend, January 1976–March 1977.

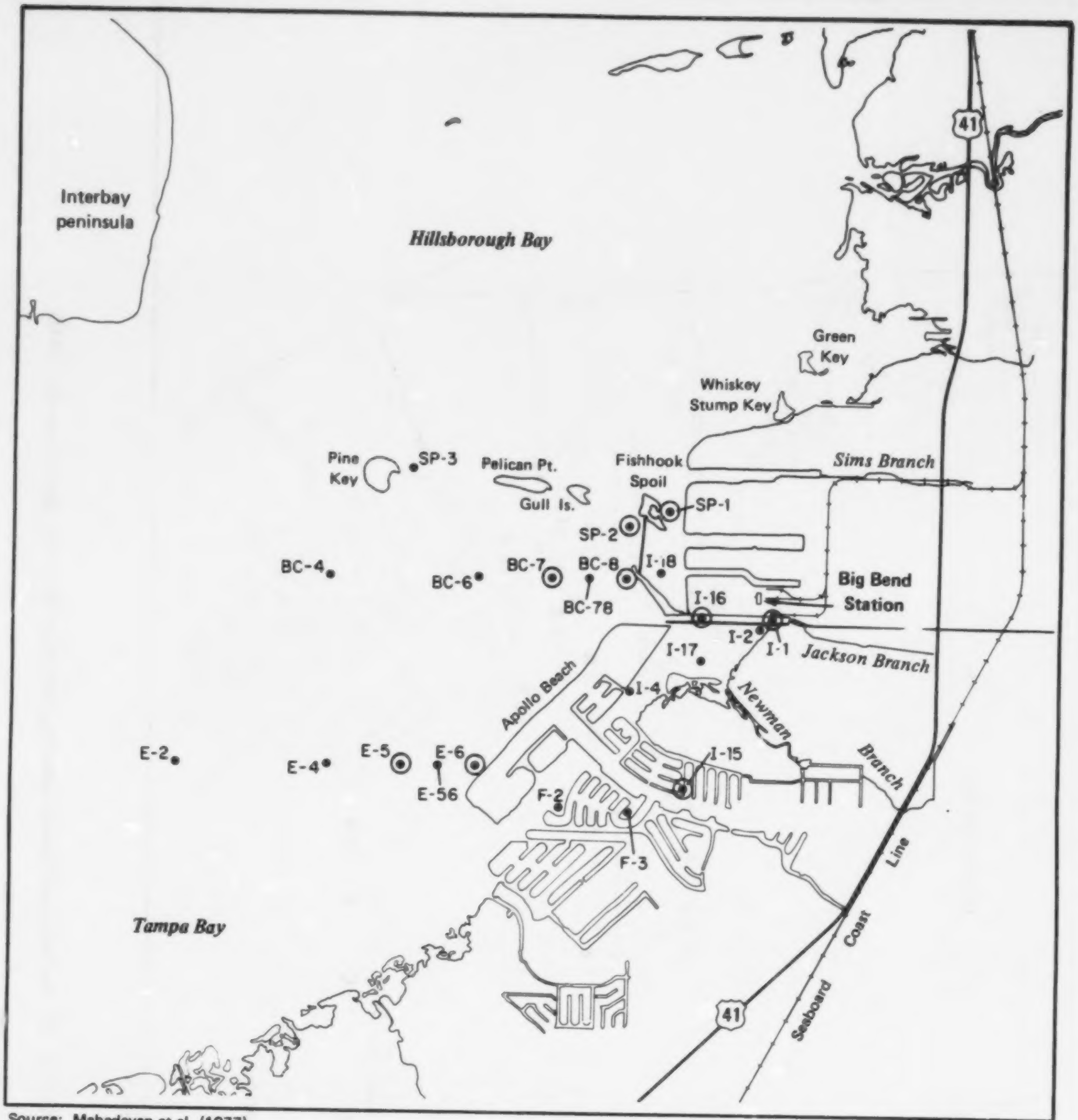

D
Interbay peninsula
Hillsborough Bay
41
C
Green Key
Whiskey Stump Key
Z
Pine Key
Pelican Pt.
Gull Is.
Sims Branch
Fishhook Spoil
A
Big Bend
B
W
Y
Jackson Branch
Newman Branch
X
E
2.0NM west
Tampa Bay
41

Source: Comp (1980).

A, B, C, D, E Trawl sampling stations
W, X, Y, Z Seine sampling stations

0
1 Mile

Figure 3-31. Seine and trawl sampling stations at Big Bend, March 1979-January 1980.

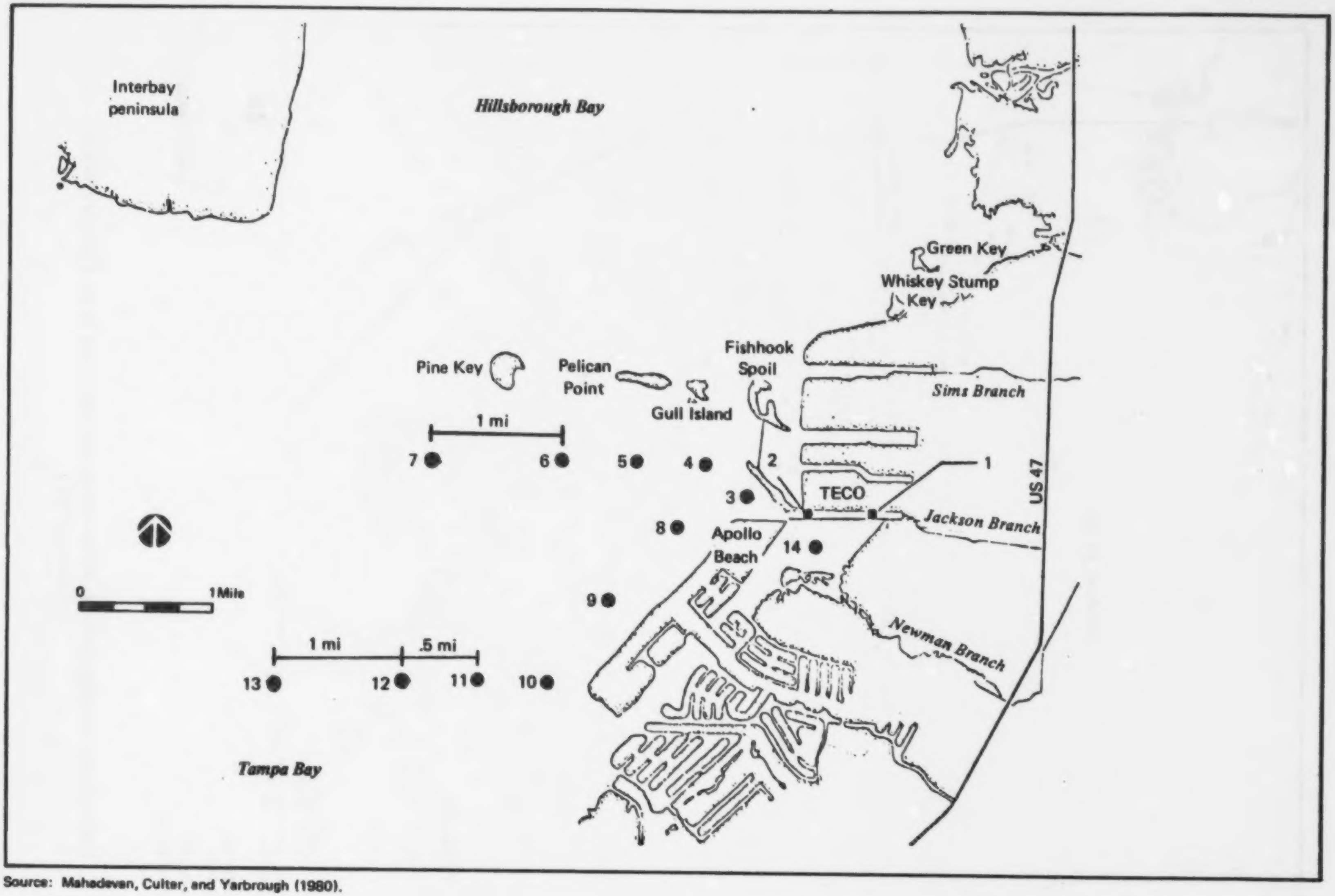

Interbay peninsula
Hillsborough Bay
41
Green Key
Whiskey Stump Key
Sims Branch
Pine Key
SP-3
Pelican Pt.
Gull Is.
Fishhook Spoil
SP-1
SP-2
BC-4
BC-6
BC-7
BC-8
I-18
BC-78
I-16
Big Bend Station
I-2
I-1
Jackson Branch
I-17
Apollo Beach
I-4
Newman Branch
I-15
E-2
E-4
E-5
E-6
E-56
F-2
F-3
Tampa Bay
Seaboard Coast Line
41

Source: Mahadevan et al. (1977).

- ● Stations sampled once a quarter
- ⊙ Stations sampled once every 6 weeks

0 1 Mile

Figure 3-32. Benthic-invertebrate-sampling stations at Big Bend, February 1976-February 1977.


Interbay peninsula
Hillsborough Bay
Green Key
Whiskey Stump Key
Fishhook Spoil
Pine Key
Pelican Point
Gull Island
Sims Branch
1 mi
7
6
5
4
2
1
US 47
3
TECO
Jackson Branch
8
Apollo Beach
14
0
1 Mile
9
Newman Branch
1 mi
.5 mi
13
12
11
10
Tampa Bay

Source: Mahadevan, Culter, and Yarbrough (1980).

Figure 3-33. Benthic-invertebrate-sampling stations at Big Bend, May-December 1979.

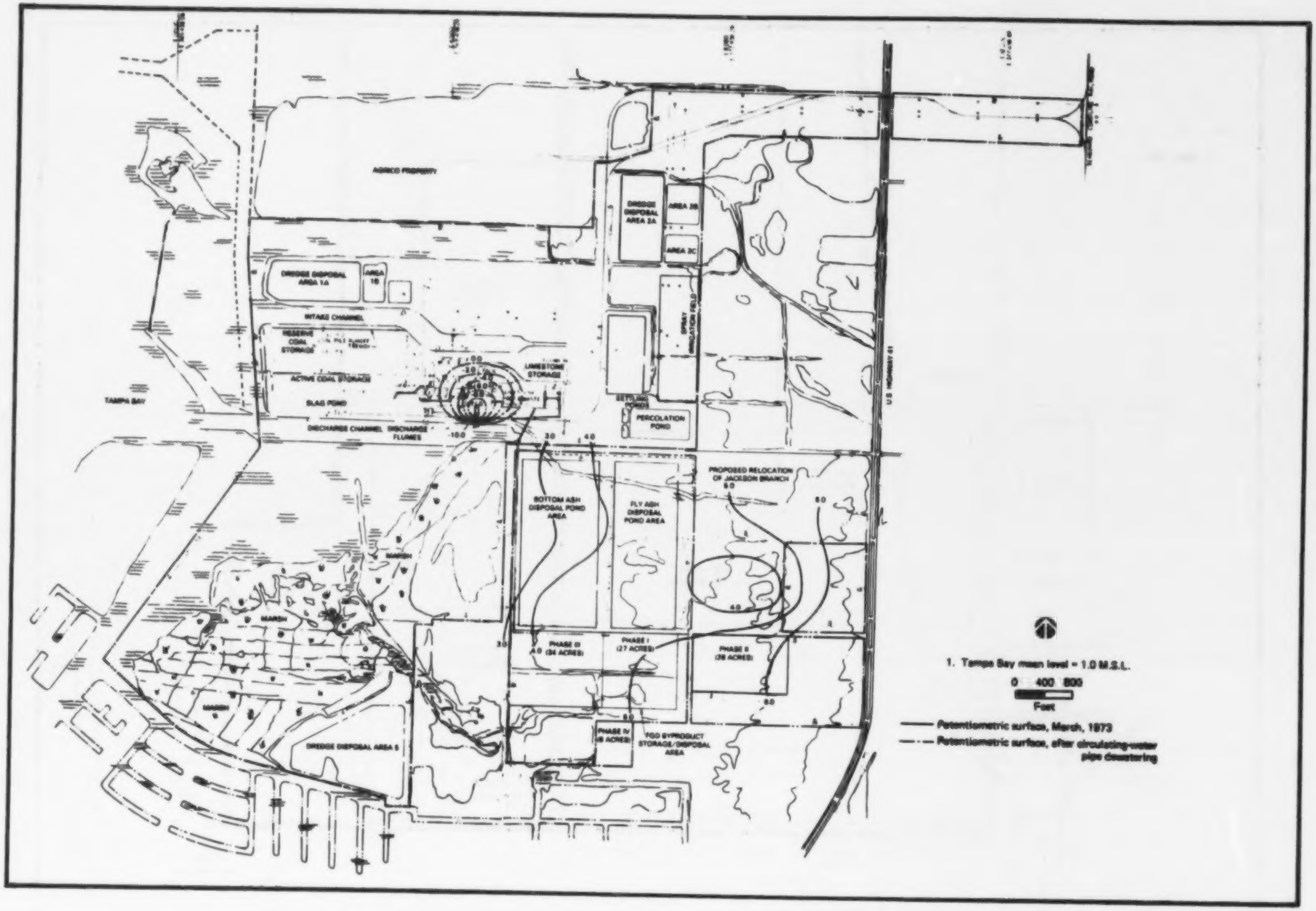
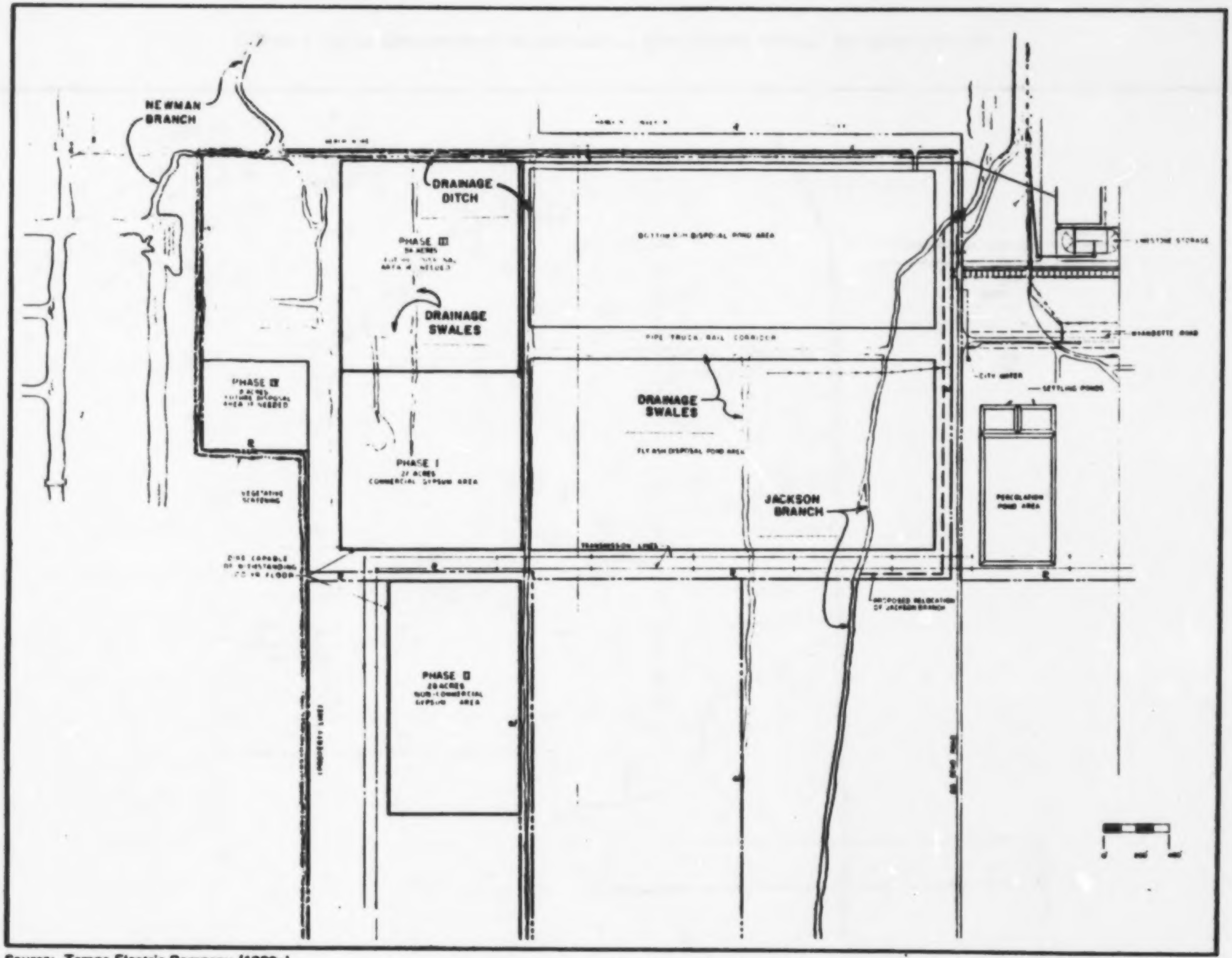
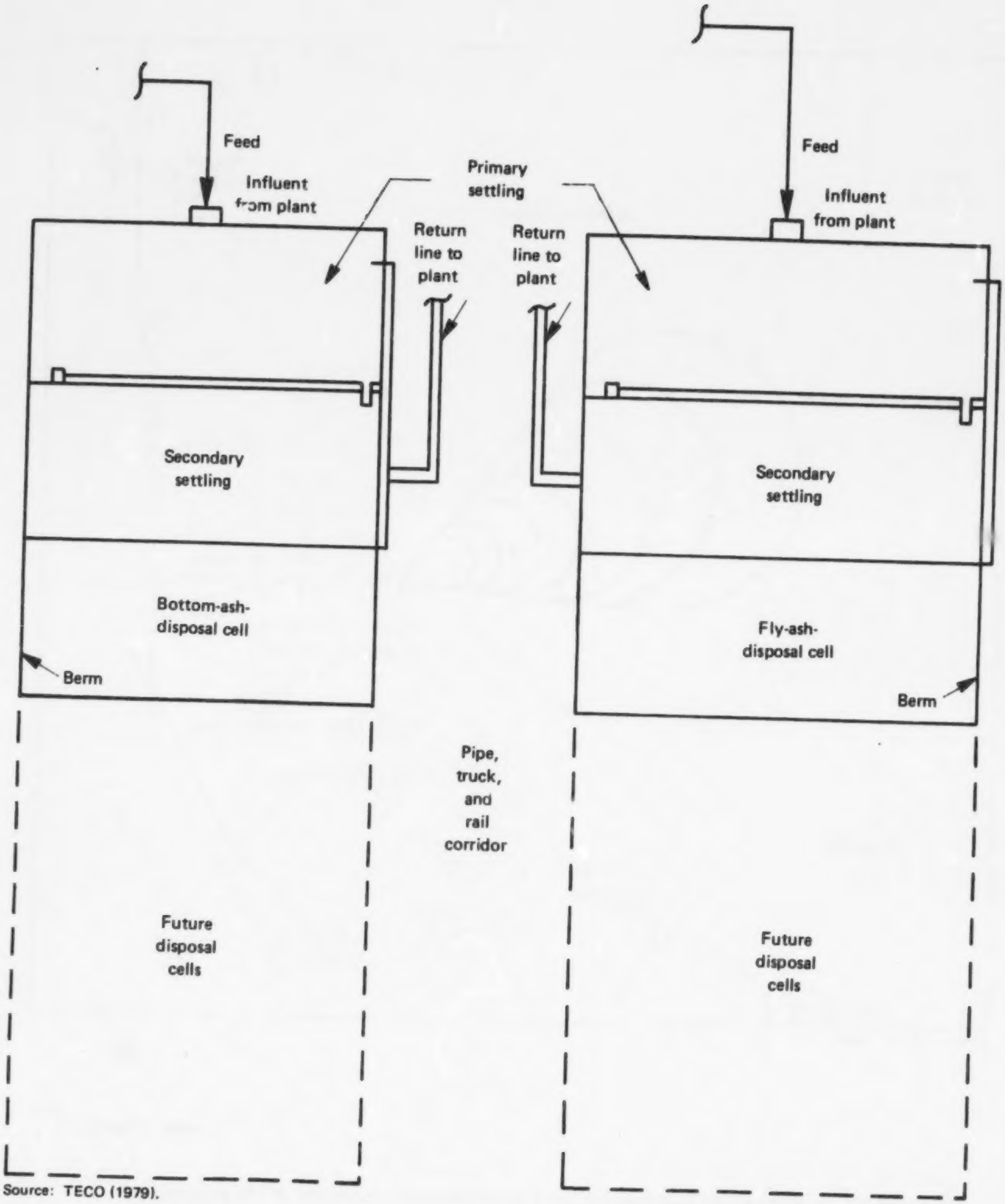

TAMPA BAY
AGRICO PROPERTY
DREDGE DISPOSAL AREA 1A
AREA 1B
INTAKE CHANNEL
RESERVE COAL STORAGE
ACTIVE COAL STORAGE
SLAG POND
DISCHARGE CHANNEL
DISCHARGE FLUMES
LIMESTONE STORAGE
1.00
2.0
-10.0
DREDGE DISPOSAL AREA 2A
AREA 2B
AREA 2C
SPRAY IRRIGATION FIELD
SETTLING PONDS
PERCOLATION POND
3.0
4.0
BOTTOM ASH DISPOSAL POND AREA
FLY ASH DISPOSAL POND AREA
PROPOSED RELOCATION OF JACKSON BRANCH
6.0
PHASE III (34 ACRES)
PHASE I (27 ACRES)
PHASE II (28 ACRES)
PHASE IV (8 ACRES)
FGD BYPRODUCT STORAGE/DISPOSAL AREA
MARSH
DREDGE DISPOSAL AREA 5
U.S. HIGHWAY 41
1. Tampa Bay mean level = 1.0 M.S.L.
0 400 800
Feet
Potentiometric surface, March, 1973
Potentiometric surface, after circulating-water pipe dewatering

Figure 3-34. Potentiometric surface map of the surficial aquifer, Big Bend Station.


NEWMAN BRANCH
DRAINAGE DITCH
PHASE III
DRAINAGE SWALES
PHASE IV
FUTURE DISPOSAL AREA IF NEEDED
VEGETATIVE SCREENING
PHASE I
27 ACRES
COMMERCIAL GYPSUM AREA
PHASE II
NON-COMMERCIAL GYPSUM AREA
BOTTOM ASH DISPOSAL POND AREA
PIPE TRUCK RAIL CORRIDOR
DRAINAGE SWALES
FLY ASH DISPOSAL POND AREA
JACKSON BRANCH
TRANSMISSION LINES
PROPOSED RELOCATION OF JACKSON BRANCH
LIMESTONE STORAGE
CITY WATER
SETTLING PONDS
PERCOLATION POND AREA

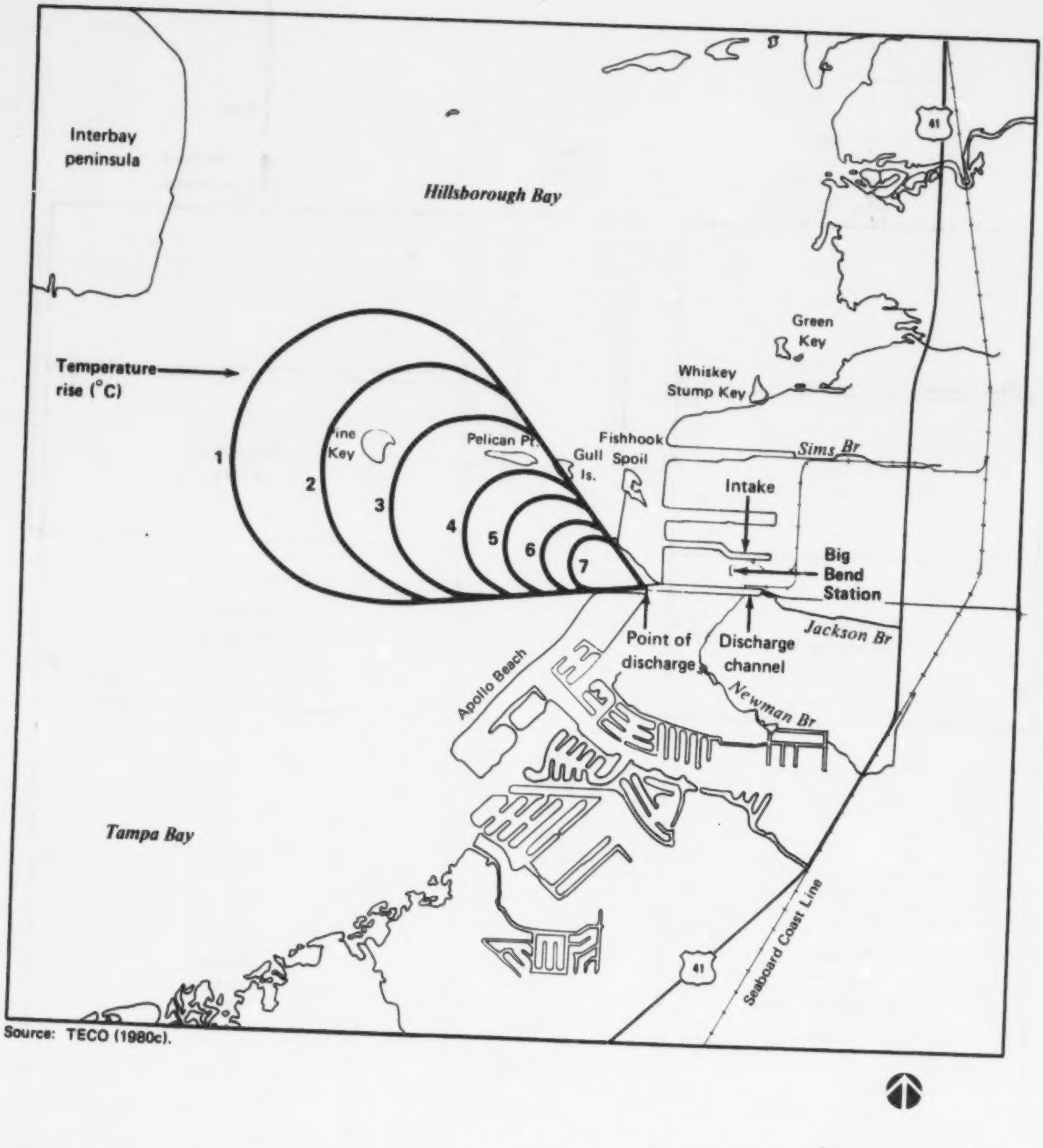
Source: Tampa Electric Company (1980a).

Figure 3-35. Bottom ash, fly ash and gypsum areas, Big Bend site.


Feed
Influent from plant
Primary settling
Return line to plant
Return line to plant
Feed
Influent from plant
Secondary settling
Secondary settling
Bottom-ash-disposal cell
Fly-ash-disposal cell
Berm
Berm
Pipe, truck, and rail corridor
Future disposal cells
Future disposal cells

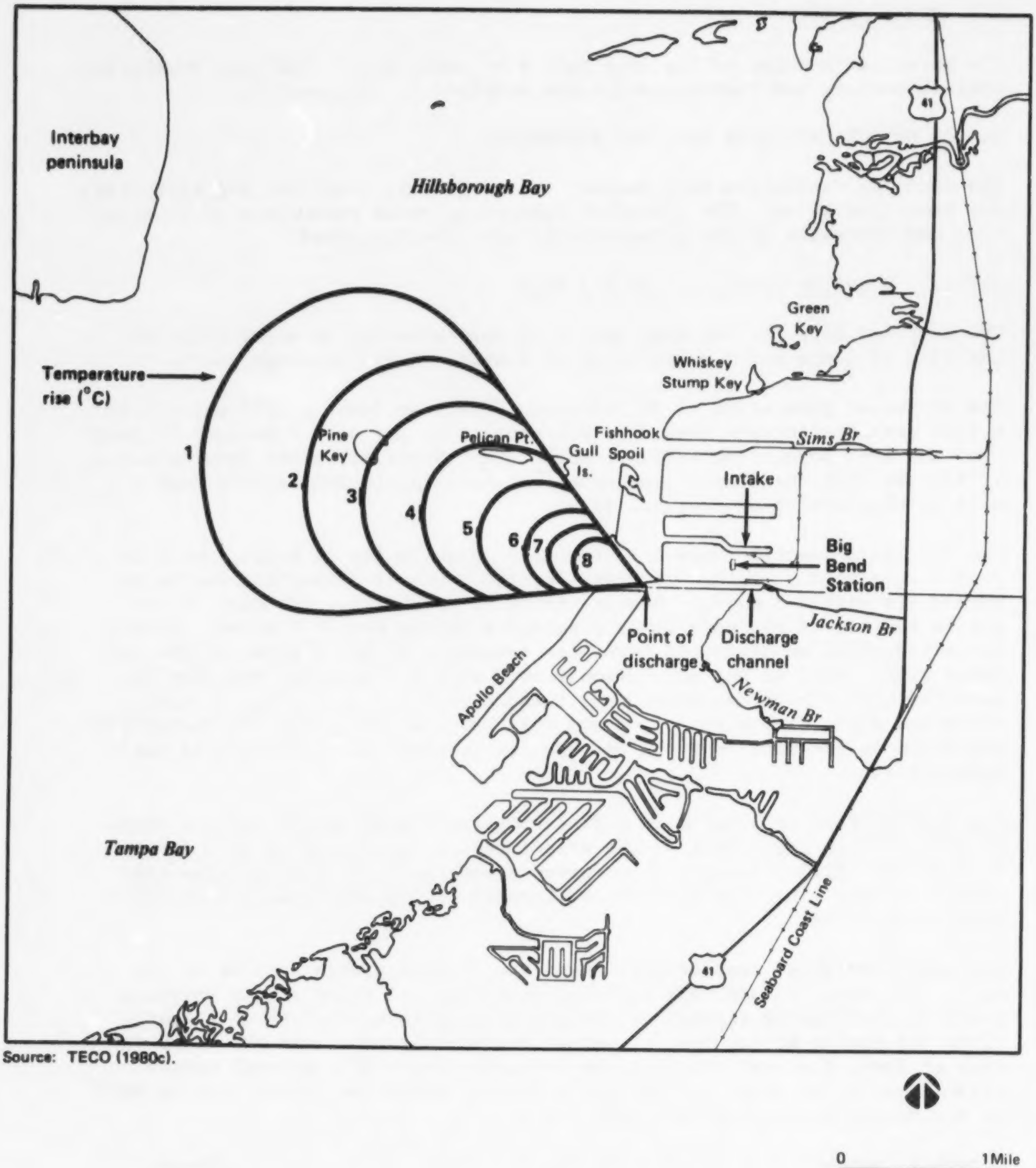
Source: TECO (1979).

Figure 3-36. Conceptual design of the bottom-ash-disposal pond and the fly-ash-disposal pond, Big Bend Unit 4.


Interbay peninsula
Hillsborough Bay
Temperature rise (°C)
1
2
3
4
5
6
7
Pine Key
Pelican Pt.
Gull Is.
Fishhook Spoil
Green Key
Whiskey Stump Key
Sims Br
Intake
Big Bend Station
Point of discharge
Discharge channel
Jackson Br
Newman Br
Apollo Beach
Tampa Bay
41
Seaboard Coast Line
0
1 Mile

Source: TECO (1980c).

Figure 3-37. Isothermal contour map for three generating units operating at 100 percent load with no dilution pumps, Big Bend Station.


Interbay peninsula
Hillsborough Bay
Temperature rise (°C)
1
2
3
4
5
6
7
8
Pine Key
Pelican Pt.
Gull Is.
Fishhook Spoil
Green Key
Whiskey Stump Key
Sims Br
Intake
Big Bend Station
Jackson Br
Point of discharge
Discharge channel
Apollo Beach
Newman Br
Tampa Bay
41
Seaboard Coast Line
0
1 Mile

Source: TECO (1980c).

Figure 3-38. Isothermal contour map for four Big Bend units operating at 100 percent load with no dilution pumps.

3.4 HUMAN FACTORS

The potential impacts of Big Bend Unit 4 on demography, land use, aesthetics, socioeconomics, and transportation are examined in this section.

3.4.1 DEMOGRAPHY, LAND USE, AND AESTHETICS

The baseline conditions with respect to demography, land use, and aesthetics are presented below. The potential impacts on these parameters of construction and operation of the proposed unit are also discussed.

3.4.1.1 Baseline Conditions at Big Bend

The proposed site for Big Bend Unit 4 is approximately 10 miles south of the city of Tampa and 5 miles north of Ruskin, in Hillsborough County.

The estimated population of Hillsborough County in January 1977 was 655,600, a 33.7 percent increase over the 1970 population and a 64.8 percent increase over the 1960 population (Hillsborough County Board of County Commissioners, 1978). By 2020 the county population is projected to increase to over 1.1 million (University of Florida, 1979).

The population center nearest to the plant site is Apollo Beach, which is just 1 mile to the south. In addition, the towns of Adamsville and North Ruskin are within 5 miles. Ruskin, south of the site on the edge of the 5-mile radius, is the only other population center within 5 miles. Several new residential subdivisions have been developed within 5 miles of the site since 1960. Most of the population growth within 5 miles of the site has occurred near Gibsonton, while more limited growth has occurred in Apollo Beach and along U.S. Highways 41 and 301. Population growth and residential expansion in the site area can be expected to continue in and around these communities.

Big Bend Station is located in a primarily rural area on the eastern shore of Hillsborough Bay. Much of the area's agricultural land is used for pasture (TECO, 1979). Swamps, flood-prone areas, and ecologically sensitive coastal waters limit residential development of the area immediately adjacent to the site.

Six parks and three recreational areas are located within 5 miles of the site. Of these, Island Park is being developed and three of the existing parks are undergoing expansion. Four parks are located north of Bisonton along the Alafia River, one is east of Big Bend Station, and one is on the edge of Tampa Bay just over 5 miles from the site. Hillsborough County established these parks for the protection of animal and plant life as well as for recreational purposes (TECO, 1979).

Growth is projected to occur along the shoreline, along major highways, and around Gibsonton and Ruskin. The Horizon 2000 Plan calls for residential development at a density of between 2.6 and 7.5 dwelling units per acre in the area just south of Big Bend Road and west of U.S. 41. Much of the region south of Big Bend Road and east of U.S. 41 is projected to remain rural (Hillsborough County Board of County Commissioners, 1978). Currently, Big Bend Station and the associated facilities are zoned industrial.

The land within 5 miles of the Big Bend site contains no distinctive natural or man-made features and no officially recognized scenic resources. This area is primarily flat, with the land surface broken only by the rapid changes in elevation occurring at stream banks and by small hills above the eastern bank of Bullfrog Creek. The most prominent features of the plant site area are the twin stacks, the lower but massive turbine buildings, and the coal-handling equipment, which extends over a large area adjacent to the main buildings.

No sites presently listed in the National Register of Historic Places or the Registry of Natural Landmarks occur within 5 miles of the Big Bend site (TECO, 1979). A cultural assessment of the area proposed for Big Bend Unit 4 and the associated facilities was conducted in 1979. A review of the Florida Master Site File revealed no archaeological or historic sites or properties within the tracts under investigation. Assessment data also led to the conclusion that the proposed development in all probability would not affect any sites listed or eligible for listing on the National Register of Historic Places (TECO, 1979).

3.4.1.2 Impacts of Construction Activities

It is estimated that an average of 514 construction workers (craft and nonmanual) will be required per year during the 3-year construction period. A peak-construction labor force of approximately 980 persons will be needed for approximately 2 months during 1984. The expected average daily labor force per year is as follows (TECO, 1980):

Year	Nonmanual	General labor and crafts	Total
1982	40	290	330
1983	57	775	832
1984	55	325	380

A survey of local union representatives (TECO, 1980b) has indicated that most of the craftsmen will be from Tampa and the surrounding communities, supplemented by people from other areas during peak periods. The percentage of local people to total workers, depending on other construction activities in the area at the same time, is expected to be about 90 percent (TECO, 1980). At the peak of construction, therefore, approximately 98 construction workers are expected to migrate into Hillsborough County.

If it is assumed that each of the potential 98 construction workers (10 percent of the peak-construction work force) brings a family (General Population Characteristics of the U.S. Bureau of the Census show a 1970 Florida average of 2.90 persons per family), the total number of persons relocating to the Tampa area as a direct result of construction will be 284, or less than 0.05 percent of the 1979 estimated total population of Hillsborough County. The residential developments nearest to Big Bend Station are at Apollo Beach, at the intersection of Big Bend Road and U.S. Highway 41, and in Adamsville. The population in these areas is sparse. Plant construction is not expected to have an impact on these communities except for intermittent traffic congestion. Plant construction is also expected to have a negligible effect on nearby recreational facilities, in view of the previous commitment of the site and adjacent areas to industrial land use (TECO, 1979).

Big Bend Unit 4 will be located on a site presently occupied by Big Bend Units 1, 2, and 3. According to the Hillsborough Horizon 2000 Plan (Hillsborough County Board of County Commissioners, 1978), Big Bend Station will be a heavy industrial area by the year 2000. Immediately adjacent lands on the north, east, and southeast have been designated for industrial use. Swamps and flood-prone areas within 5 miles of the site are expected to limit future development, however, thereby reducing the number of persons who may be directly affected by Unit 4 (TECO, 1979). Unit 4 is thus consistent with current and projected land-use patterns and practices, and it is generally expected that it will not adversely affect the land use of the area.

The construction of Big Bend Unit 4 will not cause a relocation or direct physical disturbance of any historically or culturally significant features in Hillsborough County (TECO, 1980).

The aesthetic quality of the site and surrounding area will not change dramatically during construction. Currently, 80 percent of the Big Bend site has been influenced by human activity. The area's landscape is dominated by the existing structures on the site. The flat terrain contributes to the conspicuousness of these units, as does the dense but relatively short vegetation. The additions will not significantly increase the visual or aesthetic impact of Units 1, 2, and 3 because of the size of the existing structures and the compatibility of the proposed unit with the industrial nature of the area.

Indirect impacts associated with Unit 4 construction will include the demands placed on the area by the relocation of construction workers. As the number of relocating workers is expected to be small, the induced demands and the indirect impacts on demography, land use, and aesthetics are not expected to be significant.

3.4.1.3 Impacts of Operation

The aspects of the operation of Unit 4 that could have an impact on demography, land use, and aesthetics are those related to the air-pollution-control systems.

Impacts of Sulfur Dioxide Control

The estimated yield of gypsum as an FGD byproduct will amount to 240,000 tons annually. If a market for the gypsum byproduct is established, the onsite handling of FGD wastes will be limited to storage before shipment. Given the uncertainty of marketing, however, a 97-acre FGD-waste storage and disposal area has been proposed.

The development of the FGD-waste-disposal areas is expected to have a long-term visual impact. The planting of vegetative screening around its periphery will effectively screen the fill from most viewing areas. In addition, upon reaching fill capacity, each parcel will be revegetated with native plant species to minimize the visual impact of the area. At the end of the life of Unit 4, it is expected that the disposal area will be dedicated to use as public open space.

Impacts of Particulate Control

Approximately 102,300 tons per year of fly ash will be removed from flue gas by electrostatic precipitation and collected in hoppers. Fly ash will be collected and stored for sale as a raw material for the production of cement. The use of fly ash is directly related to the level of construction activity and thus to the economic vitality of the region. A downturn in the economy may result in the need for onsite disposal.

A total of 40 acres of land would be committed for the disposal of fly ash from Unit 4. An additional 60 acres has been set aside for future expansion. The aesthetic impact of the fly-ash-disposal area is similar to that of the FGD storage and disposal area.

3.4.1.4 Impacts of Cooling Towers

A cooling tower for Big Bend Unit 4 could also have an impact on demography, land use, and aesthetics.

Saltwater Cooling Tower

A cooling tower to serve Unit 4 would have the shape of a portion of a cone. Unlike once-through cooling options, the use of a cooling tower with saltwater makeup would require additional land area. The cooling tower's height, 21 meters (70 feet), however, would be considerably less than that of other existing structures on the site. Aside from the visibility of the drift plume, the aesthetic impact of the saltwater cooling tower should not be significant. In addition, salt drift from the towers could limit the agricultural use of adjacent land to only those crops that are not salt-sensitive.

Freshwater Cooling Tower

A freshwater cooling tower would be expected to have the same dimensions as a saltwater cooling tower, and thus the same commitment of land resources and similar aesthetic impacts. The use of freshwater makeup, however, would minimize salt deposition on adjacent and nearby agricultural vegetation.

Sources of freshwater makeup within the area are limited; for the most part, they are confined to local governmental and private potable-water supplies. The only freshwater makeup water supply considered, therefore, was treated wastewater makeup. There is no such supply within several miles of the Big Bend site. Thus, a large pipeline several miles in length would be required to transport the treated wastewater to the site.

3.4.2 SOCIOECONOMICS

The socioeconomic baseline conditions at the Big Bend site are described below. This is followed by a discussion of the impacts of the construction and operation of Unit 4 and of several cooling-tower alternatives.

3.4.2.1 Baseline Conditions at Big Bend

Total personal income in Hillsborough County rose from approximately $1.69 billion in 1970 to over $3.5 billion in 1977. The per capita income also rose during this period from $3,416 to $6,145 (University of Florida, 1978). Per capita income in the Tampa-St. Petersburg Standard Metropolitan Statistical Area (Hillsborough and Pinellas Counties) is projected to increase to $12,100 by the year 2020. This rate of increase is greater than that projected for the United States but lower than the projection for the State (U.S. Water Resources Council, 1974).

The county's labor force averaged 272,519 persons in 1978. The unemployment rate for the year was 5.5 percent, which compared favorably with the State's unemployment rate of 6.6 percent and the national rate of 6 percent (Florida Department of Commerce, 1979). This level of unemployment reflected a significant decline from the 1976 high of 9.9 percent (Florida Department of Commerce, undated).

Employment is projected to increase by about 50 percent over the 1980-2020 period, reaching a total of 755,400 persons. Population gains are forecast to outstrip the expansion in employment during this same period, growing over 77 percent by 2020.

The majority of the county's workers are employed in the nonmanufacturing sectors, which consist of agricultural services and forestry; contract construction; transportation, utilities, and communications; trade (wholesale and retail); finance, insurance, and real estate; services; mining; and civil government. Of these industries, trade employs the most workers, followed by services and manufacturing (U.S. Department of Commerce, 1979). In 1977, manufacturing contributed $380,322,000 to the county's total annual payroll of $1.8 billion. Other major contributing business sectors were retail trade services and transportation (U.S. Department of Commerce, 1979).

Plant City, Tampa, and Temple Terrace are the only incorporated places in Hillsborough County. The remaining portions of the county are unincorporated and as such receive their services and financial support from the county. During the 1977-1978 fiscal year, total revenues accruing to the local governments within Hillsborough County amounted to $410,202,864. This figure includes the revenues of Plant City ($7,396,653), Temple Terrace ($9,456,878), Tampa ($161,824,626), the Hillsborough Industrial Special District ($57,747,618), and Hillsborough County itself ($173,777,089) (Greater Tampa Chamber of Commerce, undated). Taxes were the source of over 24 percent of the total revenue collected within the county during 1977-1978. Of the total revenue, 77 percent was raised from property taxes, 15 percent was from utility services taxes, and 8 percent was from franchise taxes (Florida Department of Banking and Finance, 1978).

Hillsborough County's total housing stock rose from 81,000 units in 1950 to approximately 234,000 units in 1976 (Hillsborough County Board of County Commissioners, 1978). From 1976 to 1978, 10,909 single-family units and 4251 apartment units were added to the county's housing stock (Greater Tampa Chamber of Commerce, undated). About 13,000 of the county's 1976-1977 total of 234,000 housing units were vacant. The majority of these vacancies were among multifamily units. The average vacancy rate for all multifamily units was 11 percent.

3.4.2.2 Impacts of Construction Activities

It is estimated that an average of 514 construction workers (craft and nonmanual) will be required per year during the 3-year construction period. A peak-construction labor force of approximately 980 persons will be needed for approximately 2 months during 1984.

An estimated $11,800,000 (expressed in 1982 dollars) will be paid to construction personnel over the 3-year construction period (TECO, 1980). Of this total, an estimated $10,018,200 (1982 dollars), based on national characteristics (U.S. Department of Commerce, 1979), will constitute disposable income. The expenditure of most of this money in the Tampa area will substantially benefit the local economy.

Since the relocation of construction workers and their families should produce only a small increase in the overall demand for housing and community services, no special provisions for housing, education, or community facilities are expected (TECO, 1980).

Local taxpayers are expected to predominate among construction workers using community roads, schools, and health services. Moreover, taxes on Big Bend Unit 4 will compensate Hillsborough County for the additional stress on county services attributable to the relocation of construction personnel. The total annual property tax payments to Hillsborough County for Unit 4 will be approximately $3,700,000 (TECO, 1980).

The employment of a daily average of approximately 514 construction workers over the 3-year construction period for Unit 4 will have the effect of increasing the demand for goods and services in the areas where the workers spend their wages and salaries. This change will have a "multiplier effect" in that new jobs will be created to provide the additional goods and services. The magnitude of this multiplier effect may be insignificant, however, since (1) the limited duration of the overall construction and peak construction work periods--3 years and 2 months, respectively--will discourage capital-intensive investment to meet service demands; and (2) 90 percent of the construction workers are estimated to reside within the region and may be presumed to be already contributing to the overall service demands of the region. Assuming a maximum of 75 service jobs for every 100 construction employees, 386 construction-induced jobs will be created.

The spending of disposable income during the construction period will also have a multiplier effect, since those receiving the dollars that the project workers spend will respend a portion of their income in the area. As with induced employment, however, the magnitude of this multiplier effect will be tempered by the limited duration of the overall construction and peak-construction work periods.

3.4.2.3 Impacts of Operation

The operational impact of Big Bend Unit 4 on socioeconomics will be attributable mainly to the air pollution control systems.

Impacts of Sulfur Dioxide Control

Both the capital and annual costs of TECO's proposed wet-limestone-scrubbing system are lower than those of alternative sulfur-dioxide-control systems considered, except for the lime-FGD system, provided that a gypsum-grade material is produced and marketed. Assuming capital and annual costs of the sulfur-dioxide-control technology are indicative of (1) the revenue potentially derived through taxes on the facility and (2) the annual demand for labor, supplies, and services, the proposed sulfur-dioxide-control system would result in a comparatively small economic loss to the local economy. This loss would be more than offset, however, by the development of a gypsum-grade material and the subsequent stimulation of economic growth in the local wallboard industry.

Assuming that the proposed sulfur-dioxide-control technology is used without concurrent development of a marketable gypsum-grade material, and that the sludge is stabilized and landfilled, the operations and maintenance costs for all alternatives tend to be similar. Under these circumstances, the question of economic advantage turns on comparative capital costs, and either the double-alkali process or the magnesium process may be preferable to the wet-limestone-scrubbing system.

Of the alternative sulfur-dioxide-control technologies, the wet-limestone-scrubbing system has the least water requirements. Approximately 1.0 million gallons per day of makeup water will be required for the proposed system. Current plans are to use water from the Hillsborough County South-Central System. In order to minimize the demand on this municipal system, TECO has been included in the Hillsborough County South 201 Facility Plan for the reuse of sewage effluent. According to this plan, 1.3 million gallons per day will be made available for Big Bend in 1986.

Impacts of Particulate Control

The fly ash produced through the use of an electrostatic precipitator can be sold as a raw material for the production of cement. The marketability of the fly ash for cement production is sensitive to the economic conditions within the area and the need for additional construction. The sale of fly ash as a raw material is considered a source of indirect economic benefit to the area.

3.4.2.4 Impacts of Cooling Towers

The use of cooling towers for Unit 4 could have a number of socioeconomic impacts.

Saltwater Cooling Tower

The main socioeconomic implications of a decision to use mechanical-draft cooling towers with saltwater makeup are (1) economic growth associated with the construction of additional plant facilities and (2) damage to nearby agricultural vegetation as a result of salt deposition. Cooling tower construction would contribute to the economic vitality of the region by virtue of the increased property tax levy on Big Bend Station as well as the influx of additional construction personnel. This economic benefit could be offset, however, by a loss in local agricultural productivity as the result of salt deposition.

Cooling Towers with Treated Wastewater Makeup

Cooling towers with treated wastewater makeup would be of greater economic benefit to the region than those with saltwater makeup, since a pipeline would have to be constructed to transport treated wastewater to Big Bend Station. The construction of this pipeline would require the hiring of additional construction workers.

Compared to the saltwater-makeup cooling tower, potential damage to agricultural vegetation by salt deposition from this alternative would not be as great. This advantage could be offset, however, by economic problems related to the logistics of pipeline construction.

3.4.3 TRANSPORTATION

A description of the transportation facilities in the vicinity of the site is presented below. The potential impacts of the construction and operation of Big Bend Unit 4 are also examined.

3.4.3.1 Baseline Conditions at Big Bend

Federal, State, and county highways are the primary transportation arteries in Hillsborough County. In the northern half of the county the highway system is quite extensive, particularly around Tampa. Interstate, State, and U.S. routes connect Hillsborough County with the surrounding counties of Pasco, Pinellas, and Polk. In the southern half of the county, the only primary highways are U.S. 41 and U.S. 301, both of which parallel the Tampa Bay coastline (Florida Department of Transportation, 1975). These routes pass east of Big Bend Station at a distance of 1.5 and 4 miles, respectively (TECO, 1979).

In the Horizon 2000 transportation circulation plan, the county has projected an extension of I-75 to the south. Upon completion of the extension, this four-lane expressway will run between U.S. 41 and U.S. 301 and will pass approximately 2-2/3 miles east of Big Bend Station (Hillsborough County Board of County Commissioners, 1978). U.S. 41 and Big Bend Road provide auto and truck access to the plant site. U.S. 41 is a four-lane divided highway with a 1979 average daily traffic flow (two-way combined) of 20,990 vehicles at a point just south of Big Bend Road.

All railroads in Hillsborough County are owned by the Seaboard Coast Line, and the trains mainly carry freight. As with highways, railroad tracks in the southern half of the county are limited, and only two stretches of track, running in a north-south direction, connect the county with its southern neighbor, Manatee County. One of these two tracks passes 1.5 miles to the east of Big Bend Station, and spurs from this line serve the station (TECO, 1979).

The Port of Tampa is the eighth largest port in the United States (Tampa Bay Regional Planning Council, 1977). The total tonnage passing through the port increased from 41.5 million tons in 1974 to over 48 million tons in 1978.

The major commodities flowing through the Port of Tampa are phosphate rock, petroleum, and sulfur. The port is primarily a bulk port, with general cargo accounting for only 3 percent of the total tonnage in 1978. Despite this, general cargo accounts for 24.4 percent of the port's economic value.

Total tonnage for the port is projected to reach 70 million tons by 1990 and 97 million tons by the year 2000 (Hillsborough County Board of County Commissioners, 1978), and port facilities will have to be upgraded and expanded to accommodate the additional tonnage. The Tampa Port Authority plans to assist the private sector in modernizing the facilities by issuing special-purpose, tax-free municipal bonds and by providing statistical business and economic forecasts (Hillsborough County Board of County Commissioners, 1978).

In order to accommodate larger and more fully loaded vessels in the future, a channel-improvement program will be necessary. The Tampa Harbor Deepening Project, authorized by Congress in 1970 and scheduled for completion in 1983, involves the deepening and enlargement of the main ship channels in Tampa Bay from the Gulf of Mexico to upper Hillsborough Bay. Recently, however, the project has been the subject of much criticism. Many persons are concerned about the availability of adequate spoils for the dredging of Port Tampa Channel, the cost of dredging and disposal, and the degradation of the water quality of Tampa Bay (Tampa Bay Regional Planning Council, 1977).

3.4.3.2 Impacts of Construction Activities

The most significant impact associated with the construction of Unit 4 will be the movement of workers, materials, and equipment to and from Big Bend Station. Most of the traffic will access the station from the north via U.S. 41. An average of 1100 vehicles per day (550 in each direction) will use the site during the peak-construction period in 1984. Of these 550 vehicles, an estimated 516 will be employee vehicles (assuming the carpooling of construction workers at a rate of approximately 2 persons per vehicle), 12 will be visitor vehicles, and 22 will be trucks (TECO, 1980).

U.S. 41 will generally be able to accommodate the additional construction-related traffic (TECO, 1980). During the morning and evening periods of peak traffic flow, however, intermittent traffic congestion may occur at the intersection of Big Bend Road and U.S. 41, and in the residential development of Adamsville. The community of Apollo Beach may also experience periodic traffic congestion because of its proximity to the site.

Construction materials will be transported to the site by truck, rail, and barge. As with truck transportation, the impact of rail and barge transportation is considered to be negligible. A spur from the Seaboard Coast Line Railroad to the site that was constructed for previous projects will be used for the construction of Unit 4. An additional spur will be constructed entirely within the site (TECO, 1980).

The existing Big Bend Port can accommodate additional barges. The deepening of Big Bend Channel to as much as 43 feet is currently under study by the U.S. Army Corps of Engineers. If approved, the channel deepening will permit access by larger coal-transport vessels. However, the proposed work will not interfere with the construction of Unit 4.

In Hillsborough County, the indirect impacts of construction on transportation are not expected to be significant. As indicated in the Horizon 2000 Plan, a minimum highway network with a service level of D is recommended to meet the normal traffic demand, and a minimum network with a service level of E is recommended for periods of peak traffic congestion (Hillsborough County Board of County Commissioners, 1978).* Although both direct and secondary construction-related traffic demands may cause intermittent congestion, their overall contribution to the traffic demands of the area are not expected to be significant.

3.4.3.3 Impacts of Operation

The operational impact of the proposed unit on transportation will be primarily in the areas of coal handling, sulfur dioxide control, and particulate control.

Coal-Handling Facility

The existing Big Bend Units 1, 2, and 3 burn coal delivered to the site by barge, as will Unit 4. Barges gain access to the site by a dredged channel parallel to the main ship channel. A dock provides for barge mooring and serves as a platform for the equipment that unloads the barges and transports the coal. The dredged channel and the dock serve only the Big Bend generating units. No modifications to the dock or to the unloading facilities are contemplated in connection with the construction of Unit 4. The total annual fuel requirement for Unit 4 is estimated to be 951,000 tons. An average shipment of coal is about 25,000 metric tons. Thus, the additional barge traffic required to supply fuel for Unit 4 will amount to less than one delivery per week.

Impacts of Sulfur Dioxide Control

If the gypsum byproduct of the FGD process is marketed commercially, approximately 210,000 tons of this byproduct may be transported from Big Bend Station to a local wallboard-manufacturing concern. If 10-ton trucks are used for the continuous shipment of gypsum to a local manufacturer, approximately 66 truck shipments per day will take place. While this volume of offsite truck traffic will not have a significant impact on the area's transportation network, the continuous shipments could cause intermittent traffic congestion, and, depending on shipment procedures and routes, could add to the problem of localized dust and noise.

Impacts of Particulate Control

The major offsite transportation impact attributable to the use of the particulate-control system will be the shipment of fly ash for sale as a raw material in cement production. Given an annual production rate of 102,400 tons from Unit 4, and the use of 10-ton trucks for continuous shipment, a maximum of approximately 29 truck shipments per day will be required. The combination of these 29 shipments and the estimated 66 shipments of FGD by-product gypsum (a total of 95 trucks per day) will not overtax the existing transportation network, but occasional local traffic congestion and additional dust and noise can be expected.

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*Service level D is a classification applicable to roads with typically "unstable" traffic conditions. On such roads, fluctuations in traffic are conducive to substantial reductions in vehicle speed. Service level E applies to roads on which traffic is typically "very congested." Such a classification prohibits lane changing on multilane roads and passing on two-lane roads.

3.4.3.4 Impacts of Cooling Towers

Contrary to the once-through cooling alternative, cooling-tower systems are likely to generate additional truck traffic in the area of the Big Bend Station during the construction period.

All of the cooling-tower alternatives considered in detail have a potential for the generation of localized fogging under certain atmospheric conditions. Given the distance of the station from the nearest major highway facility (i.e., U.S. 41, approximately 1.5 miles to the east), however, the potential for fogging of a major thoroughfare appears to be very limited.

3.4.3.5 Impacts of Once-Through Cooling-Water Systems

All alternative once-through cooling-water systems are equivalent in their potential for fogging. In the absence of detailed information, it may be assumed that the potential for additional fogging due to Unit 4 is slight, and that in all probability fogging would affect only water transportation in and around the station. The once-through systems would produce less fogging than would cooling towers.

3.5 SENSITIVE SPECIES, HABITATS, AND AREAS

3.5.1 BASELINE CONDITIONS AT BIG BEND

Baseline conditions with respect to special-status species and sensitive habitats at the Big Bend site are considered in the following sections.

3.5.1.1 Special-Status Species (Wildlife)

A number of special-status species reportedly use the Big Bend site and vicinity, and these species could be affected by the construction and operation of the proposed Unit 4. Those species listed by the U.S. Fish and Wildlife Service as endangered or threatened are described below. Information on Florida special-status species (endangered, threatened, rare, and of special concern), as designated by the Florida Game and Fresh Water Fish Commission and the Florida Committee on Rare and Endangered Plants and Animals, is presented in Table 3-53.

Brown Pelican (Federal status: endangered; Florida status: threatened)

Brown pelicans have been regularly observed flying near the site and feeding near the mangrove swamp south of the discharge canal. They are expected to occur in the vicinity on a daily basis owing to the presence of at least two county rookeries. No brown pelicans are believed to nest at the site.

Southern Bald Eagle (Federal status: endangered; Florida status: threatened)

Bald eagles have not been observed on the site, but several pairs regularly nest in Hillsborough County and wandering or hunting individuals could occasionally use shore and aquatic habitats at Big Bend.

West Indian Manatee (Federal status: endangered; Florida status: endangered)

There are two habitats designated as critical for the manatee in the area of Big Bend: the Alafia and Little Manatee Rivers. Individuals have also been frequently reported elsewhere along the eastern shore of Tampa Bay. In a study sponsored by the Applicant, the Big Bend power station ranked second in importance to the Gardinier Phosphate Plant on the Alafia River as a warm-water refuge in the area. As many as 10 individuals have been observed at one time in the Big Bend discharge canal (Section 3.3.1).

Sea Turtles (Federal status: endangered; Florida status: endangered)

No sea turtles have been reported on or near the site during the biological surveys conducted by the Applicant. Each of the four species (Atlantic loggerhead, Atlantic green, Atlantic leatherback, and Atlantic Ridley) may occur rarely near the site in Tampa Bay. None of these species is expected to nest at the site.

Peregrine Falcon (Federal status: endangered; Florida status: endangered)

This species can be expected to occur as a very rare migrant. It may use beach areas and mangrove swamps along the Tampa Bay shoreline to prey on shorebirds.

Eastern Indigo Snake (Federal status: threatened; Florida status: threatened)

Two individuals of this species were observed during field surveys on the site in the *Myrica*-*Baccharis* association. This species is expected to use this and possibly other habitats on the site for breeding, food, and cover.

American Alligator (Federal status: threatened; Florida status: species of special concern)

No alligators have been observed on the site, although they have been reported elsewhere along the eastern shore of Tampa Bay. The preferred habitats of this species (large freshwater bodies, swamps, and marshes) do not occur on the site, but alligators could use the brackish habitats along the edge of the mangrove swamp as well as the ditches and small ponds found in the area.

3.5.1.2 Sensitive Habitats

Two sensitive habitats can be identified on or near the site: mangrove swamp and seagrasses.

Mangrove Area

A mangrove community forms a distinct vegetational zone along the southwestern coastal portion of the site where tidal flushing occurs (Figure 3-15). This is the oldest and least disturbed plant community at the site. It contains three arborescent species: the white, red, and black mangrove. Stands of mangroves have several important ecological roles: they produce organic matter in great quantity, they build land, and they protect and provide habitats for other plants and animals.

Seagrasses

It has been estimated that benthic seagrasses and associated macroalgae cover approximately 21,000 acres on the bottom of Tampa Bay (McNulty, Lindall, and Sykes, 1972). However, surveys conducted for the Applicant in the vicinity of Big Bend indicate that seagrass coverage is limited in this area (Figure 3-29). Only one seagrass species (*Ruppia maritima*) was found in the embayment area south of the discharge canal, and both coverage and density were very low. A second area near the former dilution pump intake contained sparse growth of *Halodule wrightii* during some periods of the year.

3.5.2 IMPACTS OF CONSTRUCTION

3.5.2.1 Special-Status Species

The three bird species with special status should not be affected by construction activities except for minimal disturbance by increased noise levels. This impact will be of short duration and is not considered significant.

The manatee also should not be affected by construction activities. Its occurrence on the site has been limited to the discharge canal, and the construction and dredging for the Unit 4 outfall will be accomplished during those months of the year when the manatee is not expected to occur on the site.

The only special-status species likely to be seriously affected by construction activities is the indigo snake. It is expected that the commitment of about 218 acres of the site to the ash ponds and the gypsum storage and disposal area will result in the loss of habitat for this species. Further loss of habitat will occur if a cooling tower is constructed at Big Bend. There is not sufficient data available to predict whether this species will be eliminated from the site or merely reduced in numbers.

No alligators have been reported at the site. Accordingly, the loss of the small wetland areas and the rerouting of Jackson Branch are not expected to affect this species since these habitats are presently only marginally suitable for alligators.

No impacts are expected on any of the four species of sea turtles.

3.5.2.2 Sensitive Habitats

The construction of the intake and discharge structures will affect only small areas in the intake and discharge canals. No impact is expected on the limited areas of seagrasses in the vicinity of the site.

The layout for the proposed generating unit has been planned in such a manner that the mangrove areas will not be affected by construction activities. If cooling towers are required, they will be located near the mangrove areas. However, their placement will be such that impacts on the mangroves will be minimized.

3.5.3 IMPACTS OF OPERATION

It is anticipated that no special-status species will be adversely affected by the operation of Unit 4. The U.S. Fish and Wildlife Service, during formal consultation on the project pursuant to Section 7 of the Endangered Species Act, has concurred with this conclusion (Appendix H).

There is a possible beneficial effect of adding a fourth unit with once-through cooling at Big Bend Station: the potential for cold shock to manatees as a result of station shutdown would be reduced. The probability of a simultaneous shutdown of four generating units is lower than that of a similar shutdown of only three.

The only sensitive habitat that could be affected by this system is the mangrove area. Leachate from the unlined bottom-ash pond will enter the ground water and migrate toward the Bay. There is not sufficient information available to determine if this leachate can be taken up by the mangrove trees or if it will adversely affect them.

3.5.4 IMPACTS OF COOLING TOWERS

3.5.4.1 Special-Status Species

Potential impacts to special-status species from cooling-tower operation include the collision of the three bird species with the structure, habitat loss for the indigo snake and the alligator, and the effects of increased noise levels on all of the species.

3.5.4.2 Sensitive Habitats

The preemption of land for the cooling tower may affect the sensitive mangrove area and associated marshes. The tower will be located in such a way as to minimize any impact on this area.

In the case of brackish-water cooling towers, the withdrawal of makeup water from deep artisian aquifers may affect the quality and quantity of fresh water in shallow artesian aquifers. This, in turn, may affect vegetation in sensitive habitats on the site.

The use of freshwater cooling towers could also affect sensitive areas. It is expected that freshwater withdrawal for makeup will seriously overburden local ground-water resources, which will in turn affect vegetation in sensitive habitats on the site. Accordingly, the Applicant has investigated sources of sewage effluent to serve as cooling-tower freshwater makeup.

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Chapter 4

OTHER NEPA CONSIDERATIONS

4.1 UNAVOIDABLE ADVERSE IMPACTS

The proposed action will result in certain adverse environmental impacts, despite the emphasis on state-of-the-art impact control technology in all project particulars. Some of the impacts are unavoidable consequences of a commitment to project objectives; others, while avoidable, are regarded as insignificant compared to the cost of their elimination. In the Big Bend 4 project, every effort will be made to ensure the most environmentally favorable tradeoffs between construction and operation of the generating unit and the use of air, land, and water resources.

Descriptions of the unavoidable impacts of the new generating unit are presented in the following sections.

4.1.1 ATMOSPHERIC RESOURCES

There will be an increase in pollutants released to the atmosphere as a result of the proposed station. The emissions of sulfur dioxide, nitrogen dioxide, and particulates from the proposed station will not result in any violation of Federal or State ambient air quality standards. Air emissions will use up portions of available prevention of significant air quality deterioration Class II increments at points close to the facility. This will not preclude future industrial development in the site region.

Emissions of sulfur dioxide and nitrogen oxides have been associated with acid precipitation. To date, however, only a general relationship has been established; the relationship between emissions of the precursor pollutants from a particular source and acid deposition in a particular area remains speculative. The most highly publicized relationship is that between emissions from the industrial Midwestern and the Eastern United States and "acid rain" in the Northeastern United States and Canada.

The operation of the proposed facility will not have any significant impact on the levels of atmospheric ozone.

4.1.2 LAND RESOURCES

There will be a loss of approximately 66 acres of pastureland and 31 acres of agricultural land owing to the development of the gypsum storage and disposal area. This use of the land will result in a loss or displacement of the wildlife now using this habitat (Section 3.2.2). Approximately 121 acres of additional land will be preempted by the ash disposal system, resulting in a loss of this wildlife habitat as well.

Neither loss is considered significantly adverse because these habitats have been recently disturbed and are not unique to the Big Bend site or to the surrounding areas. Moreover, they are among the least biologically important wildlife habitats at the site.

4.1.3 WATER

Construction of the Unit 4 discharge structure will require the removal of approximately 690 cubic yards of sand and silt from the bottom of the discharge canal. This will result in the direct loss of many benthic invertebrate organisms (Section 3.3.2).

Prototype studies at the site have confirmed that the fine-mesh screening of intake structures is a feasible technology that will minimize entrainment effects. They have also shown that the installation of fine-mesh screens on the intake structures of Big Bend Units 3 and 4 will result in entrainment effects approximately equal to the current impacts associated with the operation of Units 1, 2, and 3 using conventional intake technology. These impacts, described in Section 3.3, are not expected to be significant.

4.1.4 SENSITIVE AREAS

The indigo snake is the only rare, endangered, or threatened species on which the construction and operation of Unit 4 could have a direct adverse impact. This species was reported on the site in 1974 and could occur in habitat types that will be disturbed by the Big Bend 4 project (Section 3.2.1). It cannot be determined from available information, however, whether the species presently inhabits the site and thus whether in fact it will be adversely affected.

A small 1-acre pond and marsh area will be destroyed by the construction of the gypsum storage and disposal area. This loss is not deemed significant, however, because of the small size of the area and the presence of other larger wetland areas in the region.

The existing drainage patterns on the site will be modified to accommodate disposal areas for gypsum and ash. The most significant of these modifications will be the relocation of Jackson Branch.

4.2 RELATIONSHIP OF SHORT-TERM USES OF MAN'S ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

During the proposed 30-year life of Unit 4, the air, water, and land resources of the site will be committed to the production of electric power. There will be no commitment of new resources beyond the site, since the existing transmission right-of-way will be used for new power lines and all solid wastes will be disposed of at the site or sold for commercial use.

The production of electricity during the operating life of the station will contribute to tourism and other industries within the TECO service area and within those of other utilities purchasing power from Unit 4. This electric power will accommodate the projected increase in the population of the region and will contribute to the health and safety of the general populace.

4.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The proposed plant will consume an estimated 28.5 million tons of coal during its 30-year life. The consumption of fuel oil for startup and flame stabilization is expected to be 10,143 barrels over the life of the station.

The flue-gas-desulfurization system will use an estimated 3.4 million tons of limestone during plant life. Most of this resource will be irretrievably committed; some, however, will be recovered as gypsum, which will be sold for wallboard manufacture.

Materials like concrete cannot be recycled and thus will be irretrievably committed to the construction of the station. Other materials, such as steel and aluminum, may be reclaimed if it is economically feasible.

Approximately 218 acres of agricultural and grazing land will be irretrievably committed to the storage of gypsum (97 acres) as well as bottom and fly ash (121 acres). A small 1-acre marsh will be likewise committed.

4.4 CONFLICTS BETWEEN THE PROPOSED ACTION AND THE OBJECTIVES OF FEDERAL, REGIONAL, STATE, AND LOCAL PLANS

There are no known conflicts between the proposed action and any Federal, regional, State, or local plans for the Big Bend area.

Chapter 5

LIST OF PREPARERS

Environmental Protection Agency

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Dario J. Dal Santo	Project Officer (1980-publication)
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For information on the material presented in this section, contact Dario J. Dal Santo at (404) 881-7458 (FTS/257-7458).

Chapter 6

COORDINATION LIST

The following Federal, State, and local agencies and interest groups have been requested to comment on this impact statement:

Federal Agencies

Coast Guard
Corps of Engineers
Council on Environmental Quality
Department of Agriculture
Department of Commerce
Department of Education
Department of Energy
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Economic Development Administration
Federal Aviation Administration
Federal Highway Administration
Fish and Wildlife Service
Food and Drug Administration
Forest Service
Geological Survey
Heritage Conservation and Recreation Services
National Park Service
Public Health Service
Soil Conservation Service

Members of Congress

Honorable Lawton Chiles
U.S. Senate
Honorable Sam M. Gibbons
U.S. House of Representatives
Honorable William McCollum
U.S. House of Representatives
Honorable Paula Hawkins
U.S. Senate
Honorable Andrew Ireland
U.S. House of Representatives
Honorable C. W. Young
U.S. House of Representatives

State Agencies

Honorable D. Robert Graham, Governor
Coastal Coordinating Council
Department of Agriculture
Department of Commerce
Department of Community Affairs
Department of Environmental Regulation
Department of Health and Rehabilitative Services
Department of Natural Resources
Department of the State
Department of Transportation
Geological Survey
Game and Freshwater Fish Commission

Local Agencies

Southwest Florida Water Management District
Tampa Bay Regional Planning Council
Southwest Florida Regional Planning Council
Greater Tampa Chamber of Commerce
Tampa Port Authority
City of Tampa
City of St. Petersburg
Hillsborough County Environmental Protection Commission

Interest Groups

Florida Audubon Society
Florida Sierra Cub
Izaac Walton League of America
Florida Lung Association
ManaSota-88
Florida Defenders of the Environment
Florida Wildlife Federation
Hillsborough Environmental Coalition
League of Women Voters

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Appendix A

NPDES PERMIT AND RATIONALE FOR BIG BEND UNIT 4

The draft NPDES permit for Unit 4 contained in this Appendix is designed for combination with the draft permit for Units 1-3 contained in Appendix B. This Appendix contains only those requirements which are specificially applicable to Unit 4, but does not include any of the "boilerplate" requirements of Section II which are included in Appendix B. Due to the different administrative procedures required for new sources (Unit 4) and existing sources (Units 1-3), separate applications were submitted and different NPDES Numbers assigned. However, only one permit will be issued for all four units after completion of the Environmental Impact Assessment procedures applicable to Unit 4.

Permit No.: FL0037044

DRAFT 7/9/81

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et. seq; the "Act"),

Tampa Electric Company
Post Office Box 111
Tampa, Florida 33601

is authorized to discharge from a facility located at

Big Bend Station
Unit 4
Big Bend Road
North Ruskin, Florida 33570

to receiving waters named

Hillsborough Bay

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof. The permit consists of this cover sheet, Part I 7 pages(s), Part II 12 page(s) and Part III 3 page(s).

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight, , 1987

Date Signed

Howard D. Zeller
Acting Director
Enforcement Division

DRAFT

JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee shall monitor outfall(s) serial number(s) 007 1/ - Plant Intake

Characteristic	Monitoring Requirements Measurement Frequency	 Sample Type
Flow—m^3/Day (MGD)	Continuous	Pump Logs
Intake Temperature $^{\circ}$C($^{\circ}$F)	6/day	Logs
Additional Monitoring	See Part III.E	

Intake screen wash water from Units 3 and 4 shall be discharged to the east end of the canal north of the intake canal or to a location acceptable to EPA and the State of Florida and may be discharged without limitations and monitoring requirements except for biological monitoring required by Part III.L.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Plant Intake except that temperature shall be at the condenser inlet(s).

1/ This serial number is assigned for identification and monitoring purposes only, except as noted above for discharge of intake backwash.

PART I

Page I-2
Permit No.FL0037044

DRAFT

JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 008 - Once-through condenser cooling water from Unit 4 to the plant discharge canal.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type

Note: There will be no changes to the once-through cooling water pages (I-1 and I-2) for Units 1, 2 and 3, except for the incusion of serial number "008" and Unit "4" at applicable points on those pages.

DRAFT

JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 009 - Boiler blowdown from Unit 4 to Serial number 008.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (mg/1)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	—	—	—	—	Daily	Daily Logs
Total Suspended Solids	4.9(10.8)	16.4(36.1)	30	100	2/month	Grab
Oil and Grease	2.5(5.4)	3.3(7.2)	15	20	2/month	Grab
Additional Monitoring		See Part III.E.			See Part III.E.	

The pH shall not be less than N/A standard units nor greater than N/A standard units and shall be monitored N /A.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to mixing with other plant wastes.

DRAFT

JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 010 - Bottom ash system blowdown to Serial number 008.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (mg/1)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	—	—	—	—	Continuous	Recorder
Total Suspended Solids	13.0(28.8)	43.5(96.0)	30	100	2/week	Grab
Oil and Grease	6.5(14.4)	8.7(19.2)	15	20	2/month	Grab
Additional Monitoring		See Part III.E.			See Part III.E.	

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 2/week on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to mixing with other plant wastes.

DRAFT
JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on start of discharge and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 011 - Flue gas desulfurization system blowdown to Serial number 008.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Units (mg/1)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	—	—	—	—	Continuous	Recorder
Total Suspended Solids	6.7(14.8)	22.3(49.2)	30	100	2/week	Grab
Oil and Grease	3.3(7.4)	4.5(9.8)	15	20	2/month	Grab
Additional Monitoring		See Part III.E.			See Part III,E.	

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 2/week on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): nearest accessible point after final treatment but prior to mixing with other plant wastes.

DRAFT
JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the start of discharge and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 012 and 013 - Construction dewatering waste discharge to plant intake and discharge canals, respectively.
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations	Monitoring Requirements	
	Other Units (mg/l) Daily Max	Measurement Frequency	Sample Type
Total Suspended Solids	50	1/week	Grab

The pH shall not be less than N/A standard units nor greater than N/A standard units and shall be monitored N/A.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s).
Prior to discharge to canals.

B. SCHEDULE OF COMPLIANCE

1. **The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:**

   a. Achieve effluent limitations - On start of discharge.

   b. Priority pollutant data (Part III.G.) - Submit by 12 months after commercial operation date of Unit 4

   c. Groundwater Monitoring Program (Part III.H.) - Implement approved program by one year prior to operation of Unit 4.

   d. Erosion and Sediment Control Plan (Part III.I.)
      (1) Implement approved plan - By start of on-site construction
      (2) Reports -
          (a) Quarterly with DMR's during first year
          (b) Semiannually, thereafter.

   e. Thermal Model (Part III.J.) - Verification six months prior to operation of Unit 4.

   f. Installation of fine mesh screen (Part III.K.) - Prior to Unit 4 pump testing

   g. Biological Monitoring (Part III.L.) -
      (1) Submit study plan - 18 months prior to commercial operation date of Unit 4.
      (2) Implement - one year prior to operation of Unit 4.

2. **No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.**

DRAFT

JUL 9 1981

PART III

OTHER REQUIREMENTS

E. Additional monitoring of the plant intake (007), Unit 4 once-through cooling water discharge (008), boiler blowdown (009), bottom ash blowdown (010), and flue gas desulfurization system blowdown (011) shall be conducted at a frequency of 2/month for the first 12 months following commercial operation of Unit 4, and 1/month thereafter. Samples shall be two grab composites with grabs taken not less than two hours apart. Parameters shall include total arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium and zinc.

F. There shall be no discharge to waters of the United States of low volume wastes; any water wash or chemical metal cleaning wastes; runoff from plant construction, coal pile(s), gypsum storage or disposal areas, fly ash storage or disposal areas (including that from rainfall events exceeding the 10-year, 24-hour storm); or fly ash sluice waters or blowdown.

G. Not more than 12 months after the Commercial Operation Date of Unit 4, permittee shall submit representative data as included in 40 CFR Part 122.53 (d)(7)(ii), (iii) and (iv) for serial numbers 007, 008, 009, 010, and 011. In the event than any pollutant is present at an unacceptable level, this permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable provisions of the Clean Water Act. A twelve month period is to allow stabilization of waste streams before sampling.

H. The Permittee shall implement a groundwater monitoring program approved by EPA and the State not later than one year prior to operation of Big Bend Unit 4.* Monitoring shall be performed in accordance with the approved plan. Reports shall be submitted to EPA with quarterly Discharge Monitoring Reports.

Should the reports demonstrate significant contamination of groundwater is occurring, the Permittee shall immediately consult with EPA and the State and expeditiously institute corrective measures acceptable to EPA and the State to mitigate the contamination. These measures may include but are not necessarily limited to: sealing, relocating, or altering operations of the wastewater treatment ponds, ash ponds, FGD byproduct/ash storage areas, or coal piles. If the reports demonstrate that no significant contamination is occurring from commercial operation of Unit 4, the Permittee after consultation with and approval by the Director, Enforcement Division, may reduce or eliminate the monitoring program.

In the event that changes in the monitoring program become necessary, such changes shall be approved by the Director, Enforcement Division, and the State Director prior to institution.

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*A detailed plan shall be submitted prior to issuance of the Final EIS and will be summarized therein.

DRAFT

JUL 9 1981 RI

I. The Permittee shall implement a construction erosion and sedimentation control program approved by EPA not later than the start of onsite construction.* Monitoring reports shall be submitted quarterly with the Discharge Monitoring Reports during the first year of construction and semiannually thereafter. Erosion and sedimentation control practices shall be consistent with sound engineering practices such as those contained in "Guidelines for Erosion and Sediment Control Planning and Implementation," EPA-R2-72-015 (August, 1972) or "Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity," EPA-430-73-007 (October, 1973).

J. The Permittee shall validate the area to be impacted by the thermal plume from Units 1-4 by submitting a verified thermal dispersion model at least six months prior to commencement of operation at Unit 4. EPA, the State, and TECO shall agree to a program to ensure an appropriate model is selected, verified, and utilized.

K. The fine mesh screen for the Units 3 & 4 intake structures and the organism return mechanism shall be installed and operational prior to Unit 4 pump testing.

L. A biological monitoring program shall be implemented at least one year prior to operation of Unit 4. The program shall be designed so that the potential impacts of Unit 4, in conjunction with Units 1-3, on the benthos of the Tampa Bay system and the survivability of organisms during operation of the full-scale fine mesh screens and organism return mechanism can be assessed. The program shall be approved by EPA and the State and shall be conducted for one year following start of operation of Unit 4. A proposed program shall be submitted for EPA and State approval no later than 18 months prior to commercial operation of Unit 4 (currently scheduled for the spring of 1985).

M. To alleviate potential adverse impacts to the West Indian manatee the Permittee shall post signs in the discharge canal as recommended by the U.S. Fish and Wildlife Service (USFWS). Should significant impacts to the manatee occur, the Permittee shall coordinate and work with the USFWS to mitigate these potential adverse impacts to the manatee at the Big Bend site. Measures including closure of the discharge canal boat ramp as recommended by the USFWS may be necessary to ensure adverse impacts to the manatee are eliminated.

N. The Permittee shall ensure that the mangrove swamp system located along the southwestern coastal portion of the site is not disturbed as a result of construction and operation activities associated with the Big Bend complex.

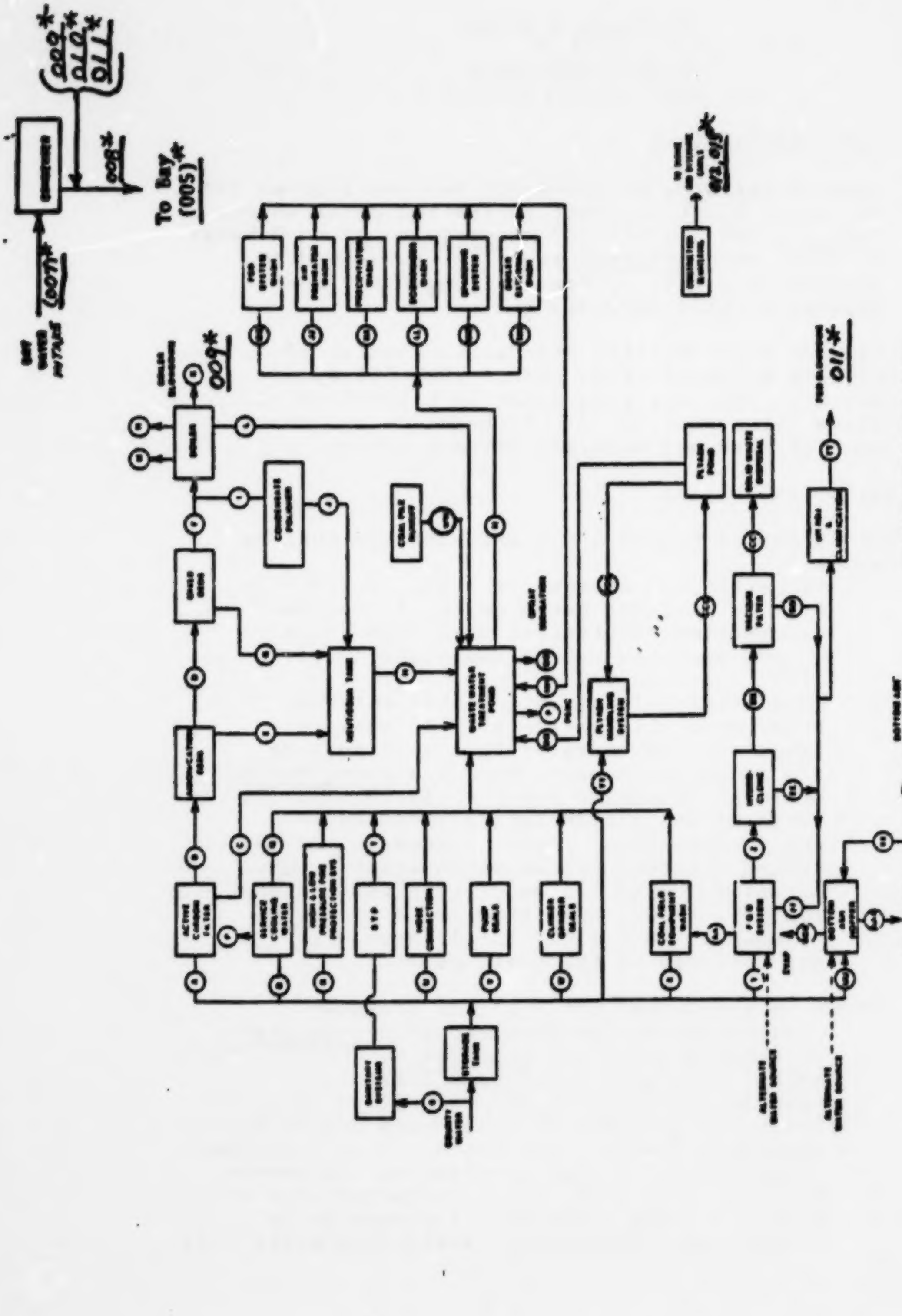
DRAFT

JUL 9 1981

O. Unless a preceding NPDES condition specifies otherwise, the Permittee shall implement its proposed project in complete accordance with the proposed action described in the Draft EIS. This shall not preclude implementation of additional or more stringent conditions required by local or state governmental bodies. Should the applicant desire significant modification, such modification must be approved by EPA prior to initiation.

P. The State of Florida Department of Environmental Regulation has certified the discharge(s) covered by this permit with conditions (Attachment B). Section 401 of the Act requires that conditions of certification shall become a condition of the permit. The monitoring and sampling shall be as indicated for those parameters included in the certification. Any effluent limits and any additional requirements specified in the attached state certification which are more stringent, supersede any less stringent effluent limits provided herein. During any time period in which the more stringent state certification effluent limits are stayed or inoperable, the effluent limits provided herein shall be in effect and fully enforceable. (Note: Certification to be provided before permit issuance.)

ATTACHMENT A
Permit No. FL0037044


(007)*
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To Bay (005)*
009*
012,013*
011*
010*

SCHEMATIC WATER FLOW DIAGRAM
TECO BIG BEND 4, OPERATION

*NPDES Serial Numbers

July 9, 1981

Big Bend Station
Unit 4
Permit Rationale
NPDES No. FL0037044

I. Applicable Regulations

A. Federal performance standards for new sources for the steam electric power generating point source category (40 CFR 423.15) as promulgated on October 8, 1974, with proposed revisions published on October 10, 1980. (See Environmental Impact Statement (EIS) Appendix J.)

B. Florida Water Quality Standards, Chapter 17-3, Florida Administrative Code. (See EIS Appendix K). The receiving water is classified as Class III - Recreation - Propagation and Management of Fish and Wildlife Surface Waters.

II. Effluent Limitations

A. NPDES Serial Number 008 - Once-through cooling water.

1. Temperature: A weekly average of 9.3 C(16.8 F) is included based on the 316(a) Determination, historical data from Units 1-3, and expected future operating levels.

2. Total residual oxidants (total residual chlorine): Limitation of 0.20 mg/l is based on Florida Water Quality Standards and is more stringent than the promulgated effluent standards (40 CFR 423.15(h)). Details of the rationale are included in the Environmental Impact Statement. A detailed chlorine minimization study is underway on Units 1-3 and future limitations (July 1, 1984), consistent with proposed standards (40 CFR 423.15(g) through (i)) are included in the draft permit.

B. NPDES Serial Number 009 - Boiler blowdown.

1. Limitations are as required by promulgated 40 CFR 423.15(g) and proposed 40 CFR 423.15(c), except that iron and copper limitations have not been included. Historical data from Units 1-3 indicate that iron and copper have been significantly below the 1.0 mg/l effluent requirement. A best professional judgement has been made that future concentrations of iron and copper from Unit 4 should be no greater than historical levels from Units 1-3.

Additionally, proposed standards have deleted boiler blowdown as a separate category and have included it in the low volume waste category, 40 CFR 423.15(c), which is not subject to iron and copper limitations.

2. Additional monitoring requirements are included to assure conformance with applicable Water Quality Standards and with probable variance requirements (See item G, below).

C. NPDES Serial Number 010 - Bottom ash system blowdown.

1. Limitations are as required by promulgated 40 CFR 423.15(d) for a recycled ash handling system. Although proposed 40 CFR 423.15(e) would allow use of a once-through bottom ash transport system, such a system is not considered viable at the Big Bend Site for Unit 4 (adequate fresh water is not available and a salt water system is not environmentally desirable, based on data from the slag pond for Units 1-3).

2. Additional monitoring requirements are included to assure conformance with applicable Water Quality Standards and with probable variance requirements (See item G, below).

D. NPDES Serial Number 011 - Flue gas desulfurization system blowdown.

1. Limitations are as required by promulgated and proposed 40 CFR 423.15(c) for low volume wastes.

2. Additional monitoring requirements are included to assure conformance with applicable Water Quality Standards and with probable variance requirements (See item G, Below).

E. Calculation of quantity limitations for Serial Numbers 009, 010, and 011. Quantity limitations are calculated as follows:

Quantity (lbs/day)=8.345 x Flow (MGD) x Allowed Concentration (mg/l) where: 8.345 is the appropriate conversion factor, flows are expected discharge flows as provided by the applicant (flow of ash sluice blowdown is five percent of the ash sluice flow for serial 010), and where concentrations (mg/l) are as provided in applicable subsections of 40 CFR 423.15, as noted below.

	30-day Average (Daily Average)	24-hour Average (Daily Maximum)
Total Suspended Solids	30	100
Oil and Grease	15	20

F. NPDES Serial Number 012 and 013 - Construction dewatering waste. Limitation is based on best professional judgement.

G. Variance. Ambient levels of arsenic, cadmium, chromium, copper, iron, mercury, nickel, and selenium exceed Florida Water Quality Standards Criteria in the Bay Waters. Therefore, the addition of any of these pollutants, regardless of how little the concentration exceeded the ambient level and/or the state criterion, would technically violate the water quality standards. Due to the relatively low expected addition of these pollutants, the applicant has requested and the staff of the State of Florida has proposed to grant a variance to the state criteria for a two-year period. During this period the permittee will be required to evaluate additional waste treatment technologies to reduce or eliminate the discharge of heavy metal pollutants and to determine actual levels of discharged pollutants. Should the variance not be granted by the State or not approved by EPA, the permittee would have to provide additional treatment prior to startup of Unit 4, or the permit could be denied. Additional information on ambient conditions and variance discussions are included in the Environmental Impact Statement.

H. Proposed Permit Period: Five years. The NPDES permit requires compliance with the most stringent requirements of either the promulgated (October 8, 1974) or proposed (October 10, 1980) standards of performance for new sources (40 CFR 423.15). Data on priority pollutants has been submitted on Units 1-3, but samples can not be collected from Unit 4 waste sources since the plant is not yet in operation. Evaluation of expected effluent quality submitted by the applicant for Unit 4 and actual analyses from Units 1-3, have led the permit writer to the tentative conclusion that additional treatment for priroity pollutants is not likely for any pollutants (other than heavy metals as described in Item G above) and that a full five-year permit should be issued. However, to assure that this judgement is correct, the permittee will be required to submit priority pollutant data, not later than one year after the commercial operation date of Unit 4. Additionally, a reopener clause is included in the permit (Part III.G.) in the event that excessive levels of priority pollutants are found.

Appendix B

NPDES PERMIT AND RATIONALE FOR BIG BEND UNITS 1-3

The draft NPDES Permit for Units 1-3 contained in this Appendix is administratively complete (contains Parts 1, II and III), but is designed for combination with the draft permit for Unit 4 contained in Appendix A. Due to the different administrative procedures required for new sources (Unit 4) and existing sources (Unit 1-3), separate applications were submitted and different NPDES Numbers assigned. However, only one permit will be issued for all four units after completion of the Environmental Impact Assessment procedures applicable to Unit 4.

Permit No.: FL0000817

DRAFT 7/9/81

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et. seq; the "Act"),

Tampa Electric Company
Post Office Box 111
Tampa, Florida 33601

is authorized to discharge from a facility located at

Big Bend Station
Units 1-3
Big Bend Road
North Ruskin, Florida 33570

to receiving waters named

Hillsborough Bay

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof. The permit consists of this cover sheet, Part I 6 pages(s), Part II 12 page(s) and Part III 1 page(s).

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight, , 1987

Date Signed

Howard D. Zeller
Acting Director
Enforcement Division

DRAFT

JUL 9

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 001, 003 and 004 - Once-through condenser cooling water from Units 1, 2 and 3, respectively,to the plant discharge canal (005[1]).

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations		Monitoring Requirements [1]	
	Weekly Average	Daily Maximum	Measurement Frequency	Sample Type
Plant Discharge temperature °C(°F)	——	N/A	Continuous	Recorder
Plant temperature rise °C(°F)	9.3(16.8)	——	6/Day	Calculations
Total residual oxidants (mg/l)	SEE	BELOW	1/Week	Multiple Grabs
Time of TRO discharge (minutes/day)	SEE	BELOW	1/Week	Determinations

There shall be no discharge from dilution pump(s) without prior approval by the Director, Enforcement Division, except that permittee is authorized to operate each pump for maintenance purposes not to exceed one-half hour per week.

Discharge of total residual oxidants(TRO) shall not exceed a maximum instantaneous concentration of 0.20 mg/l at the outlet corresponding to an individual unit during any one day. TRO shall not be discharged (except as noted below) from any unit for more than two hours in any one day and not more than one unit may discharge TRO at any one time. Notwithstanding these requirements, permittee shall institute the chlorine minimization study in accordance with plan of study submitted on February 25, 1981 and amended June 2, 1981. Status reports shall be submitted quarterly with Discharge Monitoring Reports (DMR's) indicating tests conducted and results obtained during the quarter with the first report due in October 28, 1981. Summary reports shall be submitted annually with the first report due on August 31, 1982. The summary report shall be in lieu of the April - June quarterly report.

DRAFT

JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 001, 003 and 004 - Once-through condenser cooling water from Units 1, 2 and 3, respectively, to the plant discharge canal (005 1/), CONTINUATION OF LIMITATIONS CONTAINED ON Page I-I.

After June 30, 1984, there shall be no discharge of TRO. Notwithstanding the foregoing, the permittee may, upon showing the Director, Enforcement Division, that the facility must use chlorine for cooling water system biofouling control, discharge the minimum amount of TRO necessary to operate the facility. In no case shall TRO be discharged for more than two hours per day per discharge point nor shall the TRO exceed an instantaneous maximum of 0.14 mg/1 nor 0.20 mg/1 instantaneous maximum to comply with Florida Water Quality Standards requirements, whichever is less. Not later than August 31, 1982, permittee shall submit a proposed implementation schedule to expeditiously provide controls necessary to comply with these requirements. Note: In the event that BAT regulations for control of TRO or chlorine are promulgated in a manner inconsistent with the October 14, 1980, proposed guidelines, requirements of this paragraph will be modified consistent with the promulgated regulations (40 CFR 423).

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Temperature in the plant discharge canal (005 1/) and total residual oxidants at the outlet corresponding to an individual unit prior to entering the plant discharge canal (end of individual flumes).

1/ Serial number 005 has been assigned for monitoring and reporting of flow, discharge temperature and temperature rise for the plant and shall be located after combination of serial numbers 001, 003 and 004. Reporting of flow and discharge temperature shall be provided as minimum, average and maximum based on average values for each calendar day for each month. Temperature rise shall be provided as the maximum weekly average value for each month based on calendar week average values. Records of average intake and discharge temperatures for each calendar day shall be maintained but not submitted.

DRAFT

JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s) 002 - Slag pond effluent to discharge canal (includes boiler blowdown).

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	kg/day(lbs/day)		Other Units(mg/l)			
	Daily Avg	Daily Max	Daily Avg	Daily Max	Measurement Frequency	Sample Type
Flow-m^3/Day(MGD)	—	—	—	—	Continuous 1/	Recorder 1/
Total Suspended Solids	2/	2/	6.0 3/	24 3/	5/week	24-hr Composite
Oil and grease	470(1030)	620(1370)	15	20	2/month	Grab
Heavy Metals	SEE BELOW				1/two months	24-hr Composite

Monitoring for heavy metals in the slag pond effluent shall be conducted for five consecutive days each two months on composite samples. Parameters collected shall include total arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium and zinc (all data values shall be submitted).

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/week on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Pond effluent prior to entering plant discharge canal.

1/Recording flow meter shall be installed by October 31, 1981. Until then, weir readings shall be taken 5/week.

2/The quantity of total suspended soilds discharged shall not exceed the quantity determined by multiplying the flow of slag sluice water and boiler blowdown times the difference between intake and discharge concentrations.

3/Limitations have been applied on a net basis at the request of the permittee. Net values shall be computed by subtracting the intake value from the dischargevalue for the same date. Use of a net basis shall be continued only if need for such limitations continues to exist. The permittee shall notify the Director, Enforcement Division if eligibility for this adjustment has been altered or no longer exists. In that case, the permit may be modified accordingly under 40 CFR Section 122.15. Note: In computing net values, negative values shall be considered zero.

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JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through June 30, 1982, the permittee is authorized to discharge from outfall(s) serial number(s) 006 - Coal pile runoff to plant intake canal.

Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations	Monitoring Requirements 1/	
	Instantaneous Maximum	Measurement Frequency	Sample Type
Flow-m^3/Day(MGD)	N/A	N/A	N/A
Total Suspended Solids(mg/1)	50 2/	2/week	Grab
Pond Water Level	N/A	3/week 3/	Staff Gage

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 2/week on a grab sample 1/, 2/.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Nearest accessible point after final treatment but prior to actual discharge or mixing with the receiving waters.

Subsequent to June 30, 1982, there shall be no discharge or bypass of coal pile runoff to waters of the U. S. or to any waste stream entering such waters.

1/ Monitoring for total suspended solids and pH is not required during periods of no discharge. During periods of discharge, sampling shall be representative.

2/ Applicable to any flow up to the flow resulting from a 24-hour rainfall event with a probable recurrance interval of once in ten years. If an impoundment is used by the permittee, it shall be capable of retaining the 10-year, 24-hour rainfall event. Overflows resulting from rainfall in excess of the 10-year, 24-hour event may be discharged without limitation (monitoring is required).

3/ When pond is within six inches of discharge elevation.

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JUL 9 1981

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee shall monitor outfall(s) serial number(s) 007 1/ - Plant Intake

Characteristic	Monitoring Requirements	
	Measurement Frequency	Sample Type
Flow—m^3/Day (MGD)	Continuous	Pump Logs
Intake Temperature ^{o}C(^{o}F)	6/day	Logs
Total Suspended Solids(mg/1)	5/week	24-hour Composite
Heavy Metals (See Below)	1/2 months	24-hour Composite

Intake screen wash water may be discharged without limitations and monitoring requirements to the plant intake canal.

Monitoring for heavy metals in the plant intake shall be conducted for five consecutive days each two months on composite samples. Parameters collected shall include total arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, selenium and zinc.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Plant Intake except that temperature shall be at the condenser inlet(s).

1/ This serial number is assigned for identification and monitoring purposes only, except as noted above for discharge of intake screen backwash.

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B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

   a. Chlorine minimization (001, 003 and 004)

      1. Implement - July 1, 1981.
      2. Status Reports - Quarterly with DMR's, with first report due in October 1981 (3 per year).
      3. Summary reports - Annually, with the first report due on August 31, 1982.
      4. Implementation schedule (chlorine reduction controls) - August 31, 1982.

   b. Slag pond flow recorder (002) - Install by October 31, 1981.

   c. Terminate discharge (006) - June 30, 1982

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions, taken, and the probability of meeting the next scheduled requirement.

A. MANAGEMENT REQUIREMENTS

1. Discharge Violations

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant more frequently than, or at a level in excess of, that identified and authorized by this permit constitutes a violation of the terms and conditions of this permit. Such a violation may result in the imposition of civil and/or criminal penalties as provided in Section 309 of the Act.

2. Change in Discharge

Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application at least 180 days prior to commencement of such discharge. Any other activity which would constitute cause for modification or revocation and reissuance of this permit, as described in Part II (B) (4) of this permit, shall be reported to the Permit Issuing Authority.

3. Noncompliance Notification

a. Instances of noncompliance involving toxic or hazardous pollutants should be reported as outlined in Condition 3c. All other instances of noncompliance should be reported as described in Condition 3b.

b. If for any reason, the permittee does not comply with or will be unable to comply with any discharge limitation specified in the permit, the permittee shall provide the Permit Issuing Authority with the following information at the time when the next Discharge Monitoring Report is submitted.

(1) A description of the discharge and cause of noncompliance;
(2) The period of noncompliance, including exact dates and times and/or anticipated time when the discharge will return to compliance; and
(3) Steps taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

c. Toxic or hazardous discharges as defined below shall be reported by telephone within 24 hours after permittee becomes aware of the circumstances and followed up with information in writing as set forth in Condition 3b. within 5 days, unless this requirement is otherwise waived by the Permit Issuing Authority:

(1) Noncomplying discharges subject to any applicable toxic pollutant effluent standard under Section 307(a) of the Act;
(2) Discharges which could constitute a threat to human health, welfare or the environment. These include unusual or extraordinary discharges such as those which could result from bypasses, treatment failure or objectionable substances passing through the treatment plant. These include Section 311 pollutants or pollutants which could cause a threat to public drinking water supplies.

d. Nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

4. Facilities Operation

All waste collection and treatment facilities shall be operated in a manner consistent with the following:

a. The facilities shall at all times be maintained in a good working order and operated as efficiently as possible. This includes but is not limited to effective performance based on design facility removals, adequate funding, effective management, adequate operator staffing and training, and adequate laboratory and process controls (including appropriate quality assurance procedures); and

b. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during noncritical water quality periods and carried out in a manner approved by the Permit Issuing Authority.

c. The permittee, in order to maintain compliance with this permit shall control production and all discharges upon reduction, loss, or failure of the treatment facility until the facility is restored or an alternative method of treatment is provided.

5. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to waters of the United States resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature of the noncomplying discharge.

6. **Bypassing**

"Bypassing" means the intentional diversion of untreated or partially treated wastes to waters of the United States from any portion of a treatment facility. Bypassing of wastewaters is prohibited unless all of the following conditions are met:

a. The bypass is unavoidable-i.e. required to prevent loss of life, personal injury or severe property damage;

b. There are no feasible alternatives such as use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment down time;

c. The permittee reports (via telephone) to the Permit Issuing Authority any unanticipated bypass within 24 hours after becoming aware of it and follows up with written notification in 5 days. Where the necessity of a bypass is known (or should be known) in advance, prior notification shall be submitted to the Permit Issuing Authority for approval at least 10 days beforehand, if possible. All written notifications shall contain information as required in Part II (A)(3)(b); and

d. The bypass is allowed under conditions determined to be necessary by the Permit Issuing Authority to minimize any adverse effects. The public shall be notified and given an opportunity to comment on bypass incidents of significant duration to the extent feasible.

This requirement is waived where infiltration/inflow analyses are scheduled to be performed as part of an Environmental Protection Agency facilities planning project.

7. **Removed Substances**

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering waters of the United States.

8. Power Failures

The permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during electrical power failures either by means of alternate power sources, standby generators or retention of inadequately treated effluent. Should the treatment works not include the above capabilities at time of permit issuance, the permittee must furnish within six months to the Permit Issuing Authority, for approval, an implementation schedule for their installation, or documentation demonstrating that such measures are not necessary to prevent discharge of untreated or inadequately treated wastes. Such documentation shall include frequency and duration of power failures and an estimate of retention capacity of untreated effluent.

9. Onshore or Offshore Construction

This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any waters of the United States.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Permit Issuing Authority and/or authorized representatives (upon presentation of credentials and such other documents as may be required by law) to:

a. Enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit;

b. Have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit;

c. Inspect at reasonable times any monitoring equipment or monitoring method required in this permit;

d. Inspect at reasonable times any collection, treatment, pollution management or discharge facilities required under the permit; or

e. Sample at reasonable times any discharge of pollutants.

2. Transfer of Ownership or Control

A permit may be transferred to another party under the following conditions:

a. The permittee notifies the Permit Issuing Authority of the proposed transfer;

b. A written agreement is submitted to the Permit Issuing Authority containing the specific transfer date and acknowledgement that the existing permittee is responsible for violations up to that date and the new permittee liable thereafter.

Transfers are not effective if, within 30 days of receipt of proposal, the Permit Issuing Authority disagrees and notifies the current permitttee and the new permittee of the intent to modify, revoke and reissue, or terminate the permit and to require that a new application be filed.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Act, (33 U.S.C. 1318) all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Permit Issuing Authority. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act (33 U.S.C. 1319).

4. Permit Modification

After notice and opportunity for a hearing, this permit may be modified, terminated or revoked for cause (as described in 40 CFR 122.15 et seq) including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts;

c. A change in any condition that requires either temporary interruption or elimination of the permitted discharge; or

d. Information newly acquired by the Agency indicating the discharge poses a threat to human health or welfare.

If the permittee believes that any past or planned activity would be cause for modification or revocation and reissuance under 40 CFR 122.15 et seq, the permittee must report such information to the Permit Issuing Authority. The submission of a new application may be required of the permittee.

5. Toxic Pollutants

a. Notwithstanding Part II (B)(4) above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revoked and reissued or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

b. An effluent standard established for a pollutant which is injurious to human health is effective and enforceable by the time set forth in the promulgated standard, even though this permit has not as yet been modified as outlined in Condition 5a.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing", Part II (A) (6), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act (33 U.S.C. 1321).

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. **Property Rights**

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws or regulations.

10. **Severability**

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

11. **Permit Continuation**

A new application shall be submitted at least 180 days before the expiration date of this permit. Where EPA is the Permit Issuing Authority, the terms and conditions of this permit are automatically continued in accordance with 40 CFR 122.5, provided that the permittee has submitted a timely and sufficient application for a renewal permit and the Permit Issuing Authority is unable through no fault of the permittee to issue a new permit before the expiration date.

C. MONITORING AND REPORTING

1. **Representative Sampling**

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. **Reporting**

Monitoring results obtained during each calendar month shall be summarized for each month and reported on a Discharge Monitoring Report Form (EPA No. 3320-1). Forms shall be submitted at the end of each calendar quarter and shall be postmarked no later than the 28th day of the month following the end of the quarter. The first report is due by the 28th day of the month following the first full quarter after the effective date of this permit.

Signed copies of these, and all other reports required herein, shall be submitted to the Permit Issuing Authority at the following address(es):

Permit Compliance Branch
Environmental Protection Agency
Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

3. Test Procedures

Test procedures for the analysis of pollutants shall conform to all regulations published pursuant to Section 304(h) of the Clean Water Act, as amended (40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants").

4. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The person(s) who obtained the samples or measurements;

c. The dates the analyses were performed;

d. The person(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of all required analyses.

5. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

6. Records Retention

The permittee shall maintain records of all monitoring including: sampling dates and times, sampling methods used, persons obtaining samples or measurements, analyses dates and times, persons performing analyses, and results of analyses and measurements. Records shall be maintained for three years or longer if there is unresolved litigation or if requested by the Permit Issuing Authority.

D. DEFINITIONS

1. Permit Issuing Authority

The Regional Administrator of EPA Region IV or designee.

2. Act

"Act" means the Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) Public Law 92-500, as amended by Public Law 95-217 and Public Law 95-576, 33 U.S.C. 1251 et seq.

3. Mass/Day Measurements

a. The "average monthly discharge" is defined as the total mass of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured, divided by the number of daily discharges sampled and/or measured during such month. It is, therefore, an arithmetic mean found by adding the weights of the pollutant found each day of the month and then dividing this sum by the number of days the tests were reported. This limitation is identified as "Daily Average" or "Monthly Average" in Part I of the permit and the average monthly discharge value is reported in the "Average" column under "Quantity" on the Discharge Monitoring Report (DMR).

b. The "average weekly discharge" is defined as the total mass of all daily discharges sampled and/or measured during a calendar week on which daily discharges are sampled and/or measured divided by the number of daily discharges sampled and/or measured during such week. It is, therefore, an arithmetic mean found by adding the weights of pollutants found each day of the week and then dividing this sum by the number of days the tests were reported. This limitation is identified as "Weekly Average" in Part I of the permit and the average weekly discharge value is reported in the "Maximum" column under "Quantity" on the DMR.

c. The "maximum daily discharge" is the total mass (weight) of a pollutant discharged during a calendar day. If only one sample is taken during any calendar day the weight of pollutant calculated from it is the "maximum daily discharge". This limitation is identified as "Daily Maximum," in Part I of the permit and the highest such value recorded during the reporting period is reported in the "Maximum" column under "Quantity" on the DMR.

4. Concentration Measurements

a. The "average monthly concentration," other than for fecal coliform bacteria, is the concentration of all daily discharges sampled and/or measured during a calendar month on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such month (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all the samples collected during that calendar day. The average monthly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar month. This limitation is identified as "Monthly Average" or "Daily Average" under "Other Limits" in Part I of the permit and the average monthly concentration value is reported under the "Average" column under "Quality" on the DMR.

b. The "average weekly concentration," other than for fecal coliform bacteria, is the concentration of all daily discharges sampled and/or measured during a calendar week on which daily discharges are sampled and measured divided by the number of daily discharges sampled and/or measured during such week (arithmetic mean of the daily concentration values). The daily concentration value is equal to the concentration of a composite sample or in the case of grab samples is the arithmetic mean (weighted by flow value) of all samples collected during that calendar day. The average weekly count for fecal coliform bacteria is the geometric mean of the counts for samples collected during a calendar week. This limitation is identified as "Weekly Average" under "Other Limits" in Part I of the permit and the average weekly concentration value is reported under the "Maximum" column under "Quality" on the DMR.

c. The "maximum daily concentration" is the concentration of a pollutant discharged during a calendar day. It is identified as "Daily Maximum" under "Other Limits" in Part I of the permit and the highest such value recorded during the reporting period is reported under the "Maximum" column under "Quality" on the DMR.

5. Other Measurements

   a. The effluent flow expressed as M^3/day (MGD) is the 24 hour average flow averaged monthly. It is the arithmetic mean of the total daily flows recorded during the calendar month. Where monitoring requirements for flow are specified in Part I of the permit the flow rate values are reported in the "Average" column under "Quantity" on the DMR.

   b. Where monitoring requirements for pH, dissolved oxygen or fecal coliform are specified in Part I of the permit the values are generally reported in the "Quality or Concentration" column on the DMR.

6. Types of Samples

   a. Composite Sample - A "composite sample" is any of the following:

      (1) Not less than four influent or effluent portions collected at regular intervals over a period of 8 hours and composited in proportion to flow.

      (2) Not less than four equal volume influent or effluent portions collected over a period of 8 hours at intervals proportional to the flow.

      (3) An influent or effluent portion collected continuously over a period of 24 hours at a rate proportional to the flow.

   b. Grab Sample: A "grab sample" is a single influent or effluent portion which is not a composite sample. The sample(s) shall be collected at the period(s) most representative of the total discharge.

7. Calculation of Means

   a. Arithmetic Mean: The arithmetic mean of any set of values is the summation of the individual values divided by the number of individual values.

   b. Geometric Mean: The geometric mean of any set of values is the Nth root of the product of the individual values where N is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For purposes of calculating the geometric mean, values of zero (0) shall be considered to be one (1).

c. Weighted by Flow Value: Weighted by flow value means the summation of each concentration times its respective flow divided by the summation of the respective flows.

8. Calendar Day

a. A calendar day is defined as the period from midnight of one day until midnight of the next day. However, for purposes of this permit, any consecutive 24-hour period that reasonably represents the calendar day may be used for sampling.

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JUL 9 1981

PART III

OTHER REQUIREMENTS

A. There shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid.

B. The company shall notify the Director, Enforcement Division, in writing not later than sixty (60) days prior to instituting use of any additional biocide or chemical used in condenser cooling systems, other than chlorine, which may be toxic to aquatic life. Such notification shall include·

1. Name and general composition of biocide or chemical
2. Quantities to be used
3. Frequencies of use
4. Proposed discharge concentrations
5. EPA registration number, if applicable

C. There shall be no discharge to waters of the United States of low volume wastes (wastewater from all sources except those for which specific limitations are otherwise required in this permit, including, but not limited to waste waters from wet scrubber air pollution control systems, ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, floor drainage, cooling tower basin cleaning wastes and blowdown from recirculating house service water system), or metal cleaning wastes (including water wash operations).

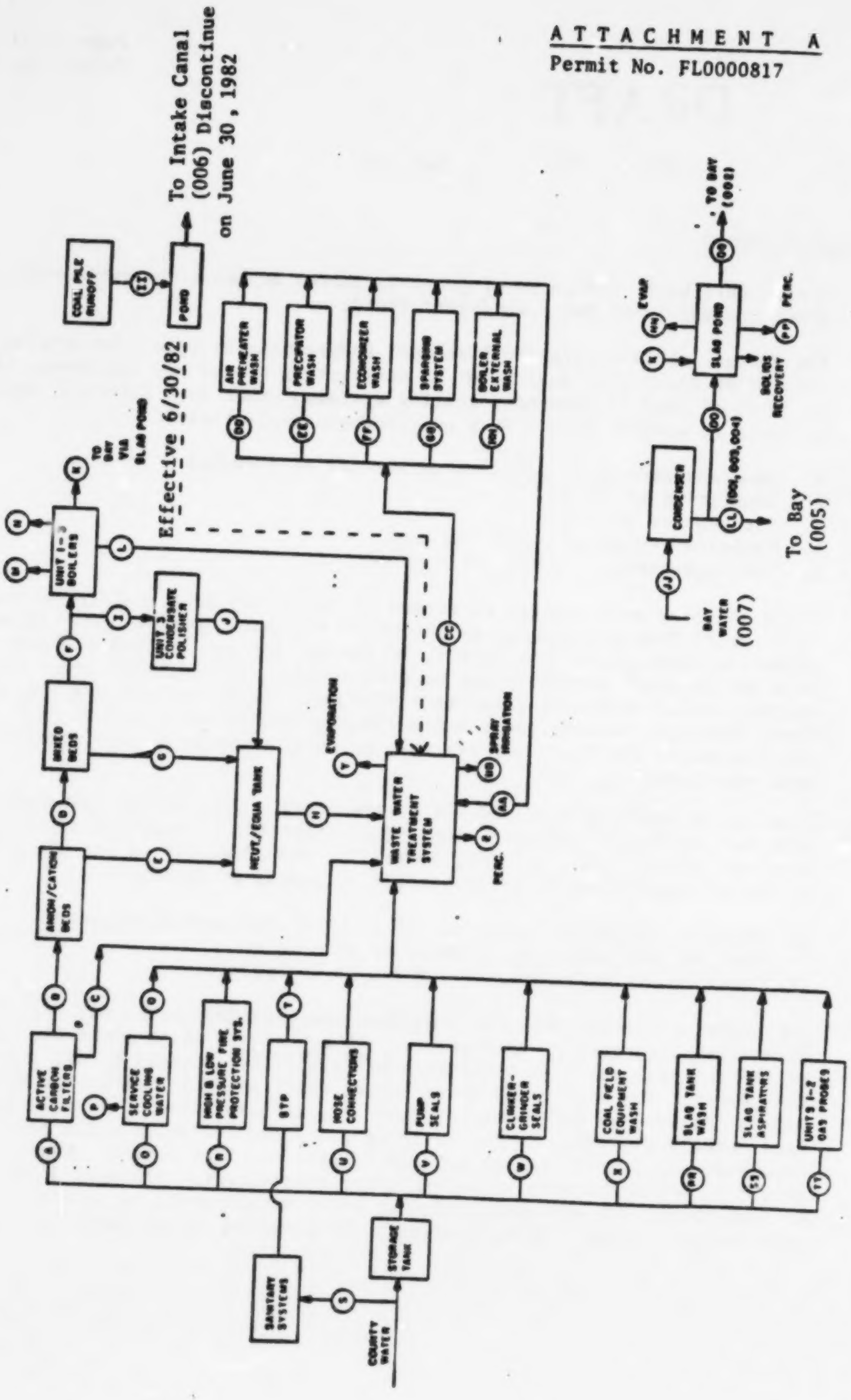
D. This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable effluent standard or limitations issued or approved under sections 301(b)(2)(C), and (D), 304(b)(2), and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

(1) Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
(2) Controls any pollutant not limited in the permit.

E. The State of Florida Department of Environmental Regulation has certified the discharge(s) covered by this permit with conditions (Attachment B). Section 401 of the Act requires that conditions of certification shall become a condition of the permit. The monitoring and sampling shall be as indicated for those parameters included in the certification. Any effluent limits and any additional requirements specified in the attached state certification which are more stringent, supersede any less stringent effluent limits provided herein. During any time period in which the more stringent state certification effluent limits are stayed or inoperable, the effluent limits provided herein shall be in effect and fully enforceable. (Note: Certification to be provided before permit issuance.)

ATTACHMENT A

Permit No. FL0000817


COUNTY WATER
SANITARY SYSTEMS
STORAGE TANK
S
A
ACTIVE CARBON FILTERS
B
C
ANION/CATION BEDS
D
E
MIXED BEDS
F
G
NEUT./EQUA TANK
H
I
UNIT 3 CONDENSATE POLISHER
J
UNIT 1-3 BOILERS
M
N
K
L
TO BAY VIA SLAG POND
O
P
SERVICE COOLING WATER
Q
R
HIGH & LOW PRESSURE FIRE PROTECTION SYS.
T
STP
U
HOSE CONNECTIONS
V
PUMP SEALS
W
CLINKER-GRINDER SEALS
X
COAL FIELD EQUIPMENT WASH
RR
SLAG TANK WASH
SS
SLAG TANK ASPIRATORS
TT
UNITS 1-2 GAS PROBES
WASTE WATER TREATMENT SYSTEM
Y
EVAPORATION
Z
PERC.
AA
BB
SPRAY IRRIGATION
CC
COAL PILE RUNOFF
II
POND
DD
AIR PREHEATER WASH
EE
PRECIPATOR WASH
FF
ECONOMIZER WASH
GG
SPARGING SYSTEM
HH
BOILER EXTERNAL WASH
BAY WATER
JJ
CONDENSER
LL
(001, 003, 004)
OO
SLAG POND
K
MM
EVAP
PP
PERC.
SOLIDS RECOVERY
QQ
TO BAY (002)

To Intake Canal (006) Discontinue on June 30, 1982

Effective 6/30/82

To Bay (005)

(007)

Schematic Water Flow Diagram
TECO Big Bend Units 1-3

July 9, 1981

Big Bend Station
Units 1, 2 and 3
Permit Rationale
NPDES No. FL0000817

I. Applicable Regulations

A. The proposed conditions provide for compliance with (1) Effluent Guidelines and Standards for the steam electric power generating point source category (40 CFR 423) as promulgated on October 8, 1974 (39 Federal Register 36186), and with proposed guidelines revisions published on October 14, 1980 (45 FR 68328) for plant chemical wastes; and (2) a tentative determination under sections 316(a) and 316(b) of the Clean Water Act for the thermal component of the discharge and for the plant cooling water intake, respectively; as well as,

B. Provisions of the Florida Water Quality Standards (Chapter 17-3, Florida Administrative Code). The receiving waters have been classified by the State of Florida as Class III - Recreation - Propagation and Management of Fish and Wildlife - Surface waters.

II. Effluent Limitations

A. Outfall Serial Numbers 001, 003, 004 and 005* - Once-through Cooling Water

1. Temperature: A weekly average of 9.3°C(16.8°F) is included based on the 316(a) Determination, historical data and expected future operating levels.

2. Total residual oxidants (total residual chlorine): Limitation of 0.20 mg/l is based on Florida Water Quality Standards and is more stringent than effluent guidelines (40 CFR 423.12(b)(7)). Details of the rationale are included in the Environmental Impact Statement for Big Bend 4. A detailed chlorine minimization study is underway and future limitations (July 1, 1984), consistent with proposed guidelines (423.13 (b) through (d)) are included.

3. Flow: Use of dilution pumps is prohibited (except for once per week maintenance) consistent with the 316(b) Determination.

B. Outfall Serial Number 002 - Slag Pond Discharge

1. Total suspended solids - Data submitted by the applicant has demonstrated that total suspended solids (TSS) present in the plant intake water are passing through the slag pond in concentrations which exceed effluent limitations (40 CFR 423.12(b)(4) and proposed 423.14(c)). Therefore, effluent limitations have been included in the draft permit based on a "net" basis as allowed in 40 CFR 122.63(h). Additional monitoring for TSS and heavy metals is included in the draft permit to demonstrate continued eligibility for and compliance with the net limitations.

* Discharge serial number 005 has been redesignated as the combined cooling water discharge (001, 003, and 004) for limitation and monitoring purposes.

Ambient levels of arsenic, cadmium, chromium, copper, iron, mercury, nickel and selenium exceed Florida Water Quality Standards Criteria; therefore, the addition of any of these parameters would technically violate the Standards. Due to the relatively low levels of addition, the staff of the State of Florida has proposed to grant a variance to State criteria for a two-year period. During this period, the Permittee will be required to evaluate additional treatment alternatives to reduce or eliminate the discharge of added heavy metals. Additional treatment technologies could include chemical precipitation, filtration and/or recycle, etc. Should the variance not be granted by the State or not approved by EPA, the permittee would have to expeditiously provide additional treatment or the permit could be denied. Additionaly information on ambient conditions and variance discussions are included in the Environmental Impact Statement for Big Bend Unit 4.

2. Oil and grease and pH permit requirements are based on requirements of 40 CFR 423.12(b)(1) and (4) and proposed 423.14(c) and (e). Quantity limitations for oil and grease are based on 15 and 20 mg/l as 30-day (daily average) and one-day (daily maximum) concentrations, respectively. Flow is based on the application (8.21 MGD average). The calculation is as follows: Quantity (lbs/day) = Concentration (mg/l) x Flow(MGD) x Conversion factor, where 8.345 is the appropriate conversion factor.

C. Outfall Serial Number 005

The application was for boiler blowdown to the slag pond; however, historical data indicates that concentrations of iron and copper have been significantly below requirements of 40 CFR 423.12(b)(6). A best professional judgement has been made that future concentrations of iron and copper should be no greater than historical values and even if they were, the slag pond would provide adequate treatment. Additionally, proposed 40 CFR 423.12 and 423.14 have deleted boiler blowdown as a separate category and have included it in the low volume waste category which is not subject to iron and copper limitations. Therefore, boiler blowdown has been excluded from separate monitoring and this waste is covered in requirements for OSN 006. OSN 005 has been redesignated as previously indicated.

D. Outfall Serial Number 006 - Coal Pile Runoff
Limitations are based on 40 CFR 423.42 and proposed 40 CFR 423.12(b)(9) and (10) and 423.14(a).

E. Other Waste Sources: Low volume wastes and metal cleaning wastes are discharged to onsite ponds for evaporation and percolation and/or are spray irrigated on the plant site. No discharge to waters of the United States occurs and therefore no limitations are included in the draft permit. Fly ash is handled dry and is presently sold.

F. Priority Pollutant Data

Data as required by 40 CFR 122.53 (d)(7)(ii) has been submitted by the applicant making it eligible for a five-year permit. Best professional judgement evaluation of the data indicates that no additional treatment is required for priority pollutants, with the possible exception of heavy metals present in the slag pond effluent. However, a final decision will be contingent on the State granting and EPA approving a variance as indicated in Item B. above. Should reduction of heavy metals be necessary, treatment technology is available to produce acceptable effluent quality (chemical precipitation, filtration, etc.)

G. Proposed Permit Period: Effluent limitations have been included in the draft permit to assure compliance with all promulgated and proposed revisions to 40 CFR 423. Additionally, a reopener clause (Part III.D.) has been included in the draft permit should more stringent requirements be promulgated than are presently proposed. (Also see Item F. above.) A five-year permit is proposed.

Appendix C

EPA FINDING AND DETERMINATION RELEVANT TO SECTION 316 DEMONSTRATION FOR BIG BEND UNITS 1-3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV

IN THE MATTER OF)
)
TAMPA ELECTRIC COMPANY NPDES PERMIT NO. FL0000817
BIG BEND STATION) TENTATIVE FINDINGS AND
TAMPA, FLORIDA) DETERMINATIONS
) UNDER 33 U.S.C. 1326

Pursuant to Section 316 of the Federal Water Pollution Control Act (the Act) (33 U.S.C. 1326) and under authority delegated by the Regional Administrator, the Director of the Enforcement Division made, on July 24, 1980, certain findings and determinations relative to Tampa Electric Company's Big Bend Units 1-3. A copy of those findings is appended to this document. Application has been made for reissuance of NPDES Permit No. FL0000817, covering Big Bend Units 1-3. With regard to the reissuance of NPDES Permit No. FL0000817 for Units 1, 2, and 3, I hereby make the following findings pursuant to Section 316 of the Act:

1. Tampa Electric Company's Big Bend Station is located on the southeastern shore of Hillsborough Bay in the Tampa Bay region. The land upon which the plant was constructed and nearby Apollo Beach were created as fill areas extending into Hillsborough Bay. The Big Bend Station operates three fossil fueled generating units with a combined rated capacity of approximately 1336 megawatts (gross). However, due to design deficiencies, the units in 1979 were limited to a combined rated capacity of approximately 1105 MW (hourly gross). Units 1 and 2 were placed on-line in October 1970, and April 1973, respectively, and Unit 3 was placed in operation in May 1976. Each of these generating units uses a once-through cooling system. These systems withdraw water from Hillsborough Bay at a combined flow rate of about 1611 cfs. An additional flow of 890 cfs is provided by a dilution pump system and combined with condenser flow to reduce discharge temperatures to Hillsborough Bay. In total, the station draws 2501 cfs from the Bay for cooling purposes.

2. The benthic region off-shore of Apollo Beach and the Big Bend industrial site presently features a sandy substrate of low organic content, mixed with moderate to low amounts of silt and clay. The shoreline can be viewed as relatively high-energy beaches with depths quickly grading to a norm of 9-12 feet (2.7 - 3.7 meters). Seagrass is not now characteristic of the benthic environment and only remnants of the shallow mangrove areas prevalent prior to the filling of Apollo Beach and the Big Bend industrial site are found in limited shore areas of the northern embayment behind Apollo Beach.

Data in the TECO report on its ichthyoplankton studies indicate the offshore area associated with the Big Bend Station serves as a spawning area for numerous species of fish, including particularly anchovies and members of the drum family.

Both anchovies and drum are viewed as inshore spawners and egg and larval densities for each remained significant with very high concentrations persisting over a seven-month period from April through October. Data given also indicate local spawning of stone crabs.

3. On February 15, 1979, tentative findings of fact were prepared from the results of a 316 demonstration submitted by the Tampa Electric Company for Big Bend Units 1, 2 and 3. The Regional Administrator determined from the facts presented that the location and capacity of the station's cooling water intake facility, which included a dilution assist cooling system, did not reflect the best technology available for minimizing adverse environmental impact due to unacceptable levels of entrainment of biota. The company responded to this determination with a proposal to terminate use of the dilution assist cooling system and provide for studies to assess the biological and associated thermal consequences of such action.

4. Retirement of the dilution pump system would reduce the withdrawal capacity of the Big Bend facility by 36 percent and theoretically effect a proportional reduction in the level of entrainment.

5. Based on plant design information, operation of Units 1, 2 and 3 at the reduced operating capacity of 1105 MW should produce a condenser flow with a maximum temperature rise of 7.7°C (13.9°F). When dilution and condenser cooling flows are combined, a normal design maximum temperature rise of 5.1°C (9.1°F) would be expected at the point of discharge. However, as shown by temperature records, temperature rises above these values do occur. For example, an average temperature rise of 7.2°C (13.0°F) was attained at the point of discharge during the months of July and August 1980. Also, maximum daily temperatures of 9.5° (17.0°F) were frequently observed. During the July-August period, the average capacity factor for Units 1, 2 and 3 was 66 percent of the reduced maximum base load and 1105 MW or 55 percent of the facility's maximum design capacity of 1336 MW.

For 1979, the daily operating load for Units 1, 2 and 3 averaged 639 MW (48 percent of the maximum rated capacity). The maximum sustained station load for a 24-hour period was reported at 1074 MW. In the foreseeable future, plant modification could provide for a station capacity of 1275 MW with instantaneous peaks of 1336 MW, the design capacity of the facility. From 1976 to 1980, plant modifications have resulted in an increase in generating capacity of 1092 to 1130 MW for Units 1, 2 and 3.

6. From May through December 1979, TECO conducted an EPA approved biological study in the area of Hillsborough Bay receiving heated discharges from the Big Bend facility. The objective of the 8-month study was to evaluate changes in the benthic macroinvertebrate community relative to increased discharge temperatures caused by cessation of the dilution assist cooling system. Shut-down of the dilution assist cooling system occurred August 3, 1979.

7. Intake temperatures of the Big Bend facility were considered representative of ambient conditions. During 1979, reported daily intake temperatures peaked during the months of July and August when water temperatures ranged from 29.4°C (85.0°F) to 32.2°C (90.0°F)

and yielded an average of 30.5°C (86.9°F) for the 2 months. Correspondingly, water temperatures at the point of discharge ranged from 32.8°C (91.0°F) to 47.2°C (117.0°F) with an average of 37.6°C (99.7°F).

8. Compared to results of a 1976 investigation reported in a previously submitted 316(a) demonstration of the Big Bend facility, a general decline in the quality of the benthic macroinvertebrate community has occurred. However this decline, measured in terms of decreases in animal abundance and species diversity, appeared as an areawide trend in the Tampa-Hillsborough Bay and was not limited to the thermally affected region associated with the Big Bend facility.

Adverse impacts related to elevated temperatures following the shut-down of the dilution pump system appeared concentrated in an area adjacent to the facility's point of discharge. A measured decrease in faunal density and species richness was observed in the benthic animal community inhabiting approximately a 7ha (17a) area adjacent to the point of discharge. A preponderance of opportunistic and pollution tolerant species characterized the variety of benthic animals inhabitating the thermally stressed area. At the time of benthic sampling, the area of impact featured bottom temperatures which ranged from a high of about 34.0°C (93.2°F) in August to a low of 23.0°C (73.4°F) in December. This area of impact represented approximately a 43 percent expansion of the thermally stressed environment previously limited to the station's discharge canal. The total area of benthic habitat subject to severe thermal stress, with shut-down of the dilution pump systems, measures about 23ha (57a).

Beyond the zone of primary impact, short-term adverse faunal effects were observed, but cannot be clearly related to water temperatures associated with the shut-down of the dilution pump system or operation of the Big Bend facility. Natural cyclic variations in the benthic animal community and areawide perturbations, such as siltation effects from the Bay deepening project, could also serve to explain the apparent trends in the quality of the benthic biota.

9. During the course of the benthic macroinvertebrate investigation, the monitoring of plume configuration under field conditions was not required. Instead, results of thermal modeling efforts conducted by the company provided a comparison of average plume conditions relative to temperatures attributable to operation of the dilution assist cooling system. With Units 1, 2 and 3 at 64 percent of maximum rated capacity, the following table illustrates the expected surface dimension of the plume with and without operation of the dilution pump.

	Area Hectares (Acres)	
Isotherm (T°C)	With Dilution Pump	Without Dilution Pump
1°	769 (1900)	923 (2280)
2°	340 (840)	437 (1080)
3°	109 (269)	219 (541)
4°	42 (104)	109 (269)
5°	5 (12)	55 (136)
6°	4 (10)	31 (77)
7°	no data	19 (47)
8°	no data	11 (27)
9°	no data	6 (15)

Because the average station load during 1979 was only 48 percent of the maximum rated capacity of the facility, the actual areal extent of the plume configuration should be less than projected by modeling results at 64 percent plant capacity.

10. Based upon results of the thermal modeling studies reported by TECO, heated effluent from the Big Bend Station will provide for a thermally stratified water column in Hillsborough Bay. At a distance of 300 m (328 yd) and 360 m (394 yd) seaward of the point of discharge, the plume is expected to detach from the bottom when Units 1, 2 and 3 are operated without dilution and at 64 and 100 percent of the rated capacity, respectively. The bottom area in direct contact with the plume would be approximately 5ha (12.4a) to 7ha (17.3a).

11. The benthic area adjacent to the point of discharge and subject to a persistent thermal impact is generally encompassed by the bottom contact boundaries of the plume as predicted by hydrographic modeling. The projected boundaries assumed no dilution and operation of Units 1, 2 and 3 at 64 and 100 percent of the design capacity of the units. However, actual plant operation was only 55 percent of maximum capacity for the period of July and August when peak ambient temperatures occurred. In 1979 the operation of Units 1, 2 and 3 averaged 48 percent of design capacity.

The biological studies showed that the area of adverse environmental impact exceeded the bottom area in contact with the projected plume. Thus, the dimensions of the plume projected by the hydrographic model cannot be utilized with confidence to predict the area of adverse thermal impact resulting from increased generation capacity. In view of this discrepancy, a linear extrapolation, which may overestimate perhaps to worst case situations, has been utilized to describe the potential area of adverse thermal impact expected to result from the combined effects of increased generative capacity and retirement of the dilution assist pumps. Based on a linear extrapolation, actual operation of Units 1, 2 and 3 at 100 percent capacity would double the area presently determined to be adversely affected by severe thermal stress.

12. Operation of Units 1, 2 and 3 at the currently established load regimen and without the benefit of a dilution assisted cooling system causes adverse impacts in approximately 23ha (57a) of benthic habitat, which includes the discharge canal. Further plant modification will provide for increases in the maximum load capability of Units 1, 2 and 3 and consequent increases in discharge temperatures. Such temperature increases will necessarily expand the boundaries of the current zone of thermal impact. Assuming that Units 1, 2 and 3 attain 95 percent of their design capacity, approximately 46ha (114a) of Hillsborough Bay, including the discharge canal, 16ha (40a), is expected to suffer adverse impacts.

13. The 46ha (114a) area predicted by linear extrapolation, while providing living space for many benthic macroinvertebrates, is nevertheless a sandy, tidal swept, high energy environment which is essentially devoid of seagrass habitat and other highly valued

habitat-forming communities, i.e., hard-bottom or coral.

Based upon the foregoing findings, I hereby determine the following:

1. The proposal to reduce the withdrawal capacity of the Big Bend facility by retiring the dilution pump system provides a new basis upon which to reassess the impact on Hillsborough Bay of entrainment to the station.

2. The reduction in capacity of the cooling water intake effected by elimination of the dilution assist pumps potentially represents a 36 percent reduction in entrainment losses.

3. The physical and chemical nature of the bottom region off-shore of Apollo Beach is such that it supports mainly a benthic macroinvertebrate community which is devoid of seagrasses and other habitat-forming features.

4. The Tampa Electric Company conducted studies adequate to demonstrate biological effects of elevated discharge temperatures resulting from cessation of the dilution assisted cooling system for Units 1, 2 and 3. The study was initiated in May 1979 and continued through December 1979. The dilution pump system was shut-down on August 3, 1979. The 8-month period of study included the time during which maximum ambient temperatures would occur in Hillsborough Bay.

5. Elevated discharge temperatures resulting from cessation of the dilution pump system caused a discernible thermal impact on the benthic invertebrate community of Hillsborough Bay. The zone of adverse impact measured approximately 7ha (17a) beyond the POD and represented about a 43 percent expansion of the thermally stressed region previously restricted to the discharge canal.

6. The entrainment level at the cooling water intake structure has been reduced to an acceptable level for the purposes of Section 316(b) of the Act.

7. The expected increase in the area of adverse environmental impact due to the thermal discharge from Big Bend Units 1-3 will not cause an unacceptable impact in Hillsborough Bay. The company's 316(a) demonstration is, therefore, accepted for the existing facilities.

Date: JUN 12 1981

Howard D. Zeller
HOWARD D. ZELLER
Acting Director, Enforcement Division

Appendix D

EPA FINDING AND DETERMINATION RELEVANT TO SECTION 316 DEMONSTRATION FOR BIG BEND UNIT 4

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV

IN THE MATTER OF)
)
TAMPA ELECTRIC COMPANY NPDES PERMIT NO. FL0037044
BIG BEND STATION) TENTATIVE FINDINGS AND
TAMPA, FLORIDA) DETERMINATIONS
) UNDER 33 U.S.C. 1326

Pursuant to Section 316 of the Clear Water Act (the Act) and 40 CFR Part 125, and under authority delegated by the Regional Administrator on August 11, 1977, I hereby make the following findings relative to proposed Big Bend Unit No. 4:

1. Tampa Electric Company's Big Bend Station is located on the southeastern shore of Hillsborough Bay in the Tampa Bay region. The land upon which the plant was constructed and nearby Apollo Beach were created as fill areas extending into Hillsborough Bay. The proposed Big Bend Unit No. 4 is a fossil fuel fired steam electric generating unit and is the fourth of four units at the Big Bend Station.

2. Addition of Unit 4 will bring the maximum capacity of the Big Bend Station to a nominal 1782 MW (gross). Operation of Unit 4 is expected to average 64 percent of its maximum design capability of 445 MW (gross).

3. The proposed method for condenser cooling for Unit 4 is once-through which is the current cooling design for Units 1 through 3. Cooling water withdrawal is via a 25 foot deep intake canal connecting to a 35 foot deep ship channel leading to Hillsborough Bay. Rate of withdrawal is 537 cfs for each unit which effects a combined cooling water requirement of 2148 cfs. Based on design information, bay water as it is circulated through the condensers will experience a temperature rise of 9.3°C (16.8°F). Based on current thermal records temperature rises frequently exceed these values.

4. The general area of Hillsborough Bay receiving the heated discharge from Units 1 through 3 is characterized by a sandy substrate of low organic content mixed with moderate to low amounts of silt and

clay, a general absence of seagrasses and an abundance of benthic macroinvertebrates. The effects of the heated discharge on the benthic community were assessed in studies conducted in 1976 and 1979.

5. Operation of Units 1, 2 and 3 at 95 to 100 percent of their design capacity and without the use of a dilution assist cooling system will cause an adverse thermal impact to approximately 30 ha (74a) of benthic habitat in Hillsborough Bay. Including the discharge canal, 16 ha (40a), a total of 46 ha (114a) would suffer adverse environmental impact from the thermal discharge.

6. With the addition of Unit 4 to the Big Bend Station, the current heat load to Hillsborough Bay is expected to increase by approximately 33 percent. Although temperature rises at the point of discharge will remain unchanged, the added thermal load to the bay will provide for an enlargement of benthic area presently subject to adverse effects. Based on a linear extrapolation, the operation of Units 1 through 4 without dilution assist cooling could potentially provide for an adverse impact to approximately 61 ha (152a) of bay bottoms.

7. Three methods were used by the company to evaluate the potential effects of entrainment of the biota of Hillsborough Bay. For the following reasons, the company's analyses fail to demonstrate the adequacy of conventional once-through cooling to minimize entrainment impacts.

- The permittee attempts to evaluate the impact of entrainment in three ways: area of entrainment influence; area of equivalent production; reduction in equivalent adults.
- Data are not available to make valid estimates of "area of entrainment influence" and "area of equivalent production." Disregarding the validity and usefulness of these estimates, it appears that the data have been analyzed

in such a manner that the estimates of impact are orders of magnitude on the low side.

- The equivalent adults model used by the permittee measures the loss of spawning stock under an assumption of equilibrium. This method does not provide a meaningful measure of impact since it ignores the forage and fishery value of the entrainment losses. Other shortcomings include: model assumptions cannot be met; faulty reasoning was used for selecting stations; and fecundity and survival estimates are not supported by the literature.
- Survival estimates for pink shrimp in the lower Gulf indicate that a conservative estimate of potential annual losses to the catchable stock may be as high as 2.3×10^6 pink shrimp. This compares with the permittee's estimate of 5275 equivalent adults -- a 436-fold difference.
- Data presented in Table 4.5-8, Appendices 2D through 2N of the demonstration show that all stages of most species are attracted to and are concentrated in the intake.

8. The addition of Unit 4 to the Big Bend Station will potentially increase the current impingement effects of Units 1 through 3 by approximately 33 percent.

9. The company constructed and tested a prototype fine-mesh screening apparatus to determine its efficacy as an intake device to reduce entrainment effects associated with the operation of Units 1 through 4 with a once-through cooling system. Results of these tests show the following:

- The prototype device appeared to be approximately 56 percent effective in screening eggs and larvae from source water. Suggested changes in the design of the spraywash system, lifting buckets and seals are proposed as means to substantially improve the screening efficiency of the intake device.
- Fish eggs and invertebrate larvae collected from the fine-mesh screen exhibited a low level of mortality. Many of the taxa involved were species of sport and commercial value, i.e., stone crab and drum.
- Fish larvae collected from the fine-mesh screens or by plankton nets for control tests exhibited a high degree of mortality. The observed mortality, however, cannot be concluded to be solely due to impingement effects of the fine-mesh screen. Testing procedures, i.e., sampling and hauling, can be viewed as factors contributing to the apparent low survival of the larval organisms. The immediate return of animals upon collection from the screening device may enhance the survival of fish larvae.
- The proposed transport system of animals to the dead-end waterway north of the plant appears to be an acceptable organism return system. Additional testing is necessary to verify the dispersion of returned organisms to Hillsborough Bay.

Based upon the foregoing findings, I hereby determine the following:

1. The Tampa Electric Company conducted studies to assess the potential environmental impacts associated with the operation of a fourth unit at the Big Bend Station. As with Units 1, 2 and 3, the company proposes to operate the fourth generating unit with conventional, once-through cooling. The investigations were conducted in accordance with study plans and quality assurance procedures reviewed by and acceptable to EPA personnel.

2. All stages of most species of meroplankton are attracted to and are concentrated in the intake canal. Such a phenomenon when accompanied by the increased intake is indicative of an intake design which does not reflect best technology available to minimize adverse environmental impact.

3. The operation of Units 1 through 4 without a dilution assist cooling system will potentially cause an adverse thermal impact to approximately 61ha (152a) of benthic habitat. The thermal impact, however, would not be viewed as substantial or unacceptable in terms of thermal damage to the benthic biota of Hillsborough Bay, because of the sandy, tidal swept nature of the benthic area subject to the impact and the fact that it does not represent primary benthic habitat which includes seagrass and other habitat forming community.

4. Based on the results of the Fine-Mesh Screening Prototype Studies, sufficient information was provided to determine that the fine-mesh screening of intake structures is a viable technology that will minimize entrainment effects. Furthermore, the installation of fine-mesh screens on Big Bend Units 3 and 4 will provide for entrainment effects approximately equal to the current impacts associated with the operation of Units 1, 2 and 3 with conventional intake technology.

5. The design modification effected by the addition of fine-mesh screens at the cooling water intake for Units 3 and 4 minimizes adverse environmental impact for the purposes of Section 316(b) of the Act.

6. The expected increase in the area of adverse environmental impact due to the thermal discharge from Big Bend Units 1-4 will not cause an unacceptable impact in Hillsborough Bay. The company's 316(a) demonstration is, therefore, accepted.

Date: JUN 12 1981

Howard D. Zeller
HOWARD D. ZELLER
Acting Director
Enforcement Division

Appendix E

PRELIMINARY DETERMINATION ON PSD APPLICATION FOR BIG BEND UNIT 4

JUN 11 1981

APPLICATION PSD-FL-040
PRELIMINARY DETERMINATION

I. Applicant

Tampa Electric Company (TECO)
Post Office Box 111
Tampa, Florida 33601

II. Location

The proposed modification is located 5 miles north of Ruskin, Hillsborough County, 10 miles south of the city of Tampa and 14 miles east of St. Petersburg at Big Bend between Tampa and Hillsborough Bays, Florida. The site is located west of U. S. Highway 41 in the vicinity of Big Bend Road. The UTM coordinates are 3075.0 km north and 361.6 km east.

III. Project Description

The applicant proposes to modify their Big Bend power generating facility by construction of a fourth coal-fired steam electric generating station (Big Bend Unit 4) with a net 417 megawatt capacity. The new unit is to utilize the existing stack servicing Big Bend Unit 3. The boiler will fire a maximum of 4330 million Btus per hour or approximately 206.5 tons per hour of a medium sulfur bituminous coal having a maximum higher heating value of 12,628 Btu/lb on a dry basis. Of the coal under consideration, the maximum sulfur content coal has, as received, 4.0 percent sulfur by weight.

Coal and limestone materials handling, storage and preparation facilities also will be constructed. Coal washing facilities will not be located at the plant. The scheduled starting date for commercial operation of Big Bend Unit 4 steam electric generating station is the first quarter of 1985 calendar year.

Specific emitting facilities to be constructed are as follows:

1. Steam generator (425 MW; 4330 MMBtu/hr);
2. Coal receiving facilities (barge);
3. Coal transfer facilities;
4. Coal storage pile;
5. Coal preparation (crushing facilities);
6. Limestone receiving facilities (rail);

7. Limestone storage pile (enclosed);
8. Limestone transfer facilities;
9. Limestone day storage silos;
10. Flyash handling system and storage silos.

IV. Source Impact Analysis

Prevention of Significant Deterioration (PSD) air quality review is required for a modification to a major stationary source which significantly increases emissions of any pollutant regulated under the Clean Air Act, consistent with the provisions of 40 CFR 52.21 promulgated August 7, 1980. The source is a fossil fuel fired steam electric plant (>250 MMBtu/hr). The three existing coal fired units clearly emit greater than 100 tons per year and therefore constitute an existing major stationary source. Table 1 shows the emissions increases from the proposed modification. It is clear that PSD review applies for emissions of particulate matter (PM), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and carbon monoxide (CO).

Full PSD review involves evaluation of the following:

1. Best Available Control Technology (BACT);
2. National Ambient Air Quality Standards (NAAQS) impacts;
3. Increment impact;
4. Impacts on soils, vegetation, and visibility;
5. Growth impacts; and
6. Class I area impacts.

A. Best Available Control Technology Analysis (BACT)

A BACT analysis is required consistent with 40 CFR 52.21(j) for each pollutant with a significant emissions increase, which, for the proposed modification, includes SO_2, PM, NO_x and CO.

1. Sulfur Dioxide Emissions Control

BACT for SO_2 is required on the steam generator (boiler) which is the only SO_2 emitting facility affected by the modification. The applicant proposes to use a nonregenerable limestone scrubber system with removal efficiencies of greater than or equal to 86 percent. The coal will be pretreated by washing to yield about a 25 percent potential SO_2 emissions reduction. An additional 5 percent is expected to remain in the recovered ash. The applicant proposes an overall sulfur removal efficiency of 90 percent for this system.

The New Source Performance Standard (NSPS) for electric utility steam generation was promulgated June 11, 1979. This limits SO_2 emissions to 10 percent of potential SO_2 emissions and a maximum of 1.2 lb/MMBtu heat input except when the emissions are less than 0.6 lb/MMBtu. At these rates a minimum of 70 percent reduction (30 percent of potential emitted) in potential SO_2 emissions is required. For SO_2 emissions rate below 0.2 lb/MMBtu, no percent reduction is required. The percentage reduction in potential SO_2 emissions depends on the sulfur content of the coal.

The BACT analysis considered three alternative coals with washed coal properties as follows:

	Coal F-1A	Coal F-2A	Coal F-2B
Heating Value (Btu/lb Dry Basis)	12,275	12,626	12,628
Sulfur Content (Dry Basis; Percent By Weight)	3.42	3.91	4.00

Coals F-2A and F-2B were the specific coals considered in developing design specifications for the flue gas desulfurization (FGD) system. Firing of these coals in the boiler controlled with the proposed control system (25% sulfur removal from washing, 5% sulfur removal in ash and 86% sulfur removal in the FGD; totaling 90% sulfur removal), yields SO_2 emission rates as follows for the 4330 MMBtu/hr boiler.

Emissions Rate	Coal F-1A	Coal F-2A	Coal F-2B
lb/MMBtu	0.74	0.82	0.84
lb/hour	3217	3576	3657

The applicant proposed an allowable SO_2 emissions limit range of 0.77 to 0.82 lbs/MMBtu to be determined on a 30-day rolling average. In the Preliminary Determination an SO_2 emission limit of 0.63 lb/MMbtu was established based on a misinterpretation of information contained in the application. In making a final determination the economics of the proposed SO_2 controls were reevaluated and BACT is determined to be an SO_2 allowable limit of 0.82 lb/MMBtu (30-day rolling average). This limit is equivalent to the upper end of the range proposed by the applicant.

The emissions limit was set on the worst case of those cases considered in the BACT analysis to provide maximum flexiblity for the applicant in the choice of coals and operation of the system. The sulfur dioxide content of the flue gas will be continuously monitored and recorded to determine compliance with the allowable emissions limit. In addition, NSPS percent reduction requirements will be met through coal sulfur content monitoring and other procedures established in 40 CFR 60 Subpart Da.

2. Particulate Matter (PM)

BACT is required for all PM emitting facilities including the boiler and coal, limestone and flyash handling and storage facilities. The applicant proposes to install an electrostatic precipitator (ESP) with a removal efficiency greater than 99 percent to control emissions of TSP from the boiler.

The New Source Performance Standard for electric generating stations promulgated June 11, 1979, stipulates particulate emissions be no greater than 0.03 lb/MMBtu. The applicant proposes that PM allowable emissions rates be 0.03 lb/hr (130 lb/hr) and 20 percent opacity to comply with the New Source Performance Standard (NSPS) and to meet BACT. EPA agrees that this limit meets BACT for PM for this boiler. The collection efficiency will be required to be greater than 99 percent. Two performance tests will be required; one test will be initiated 90 days after commercial operation and the second will be within 12 months of the first successful performance test, consistent with NSPS requirements. In addition, opacity will be continuously monitored.

Fugitive emissions from coal handling will be controlled by 1) proper maintenance of the coal piles, 2) enclosure of all conveyors and transfer points and 3) water spraying. In addition, mean precipitation, 49.4 inches per year and more than 0.1 inches on 107 days per year, act to minimize dust generation from erosion and mechanical disturbance. During dry periods and high winds, water spraying of the coal pile and all drop points is required. Moreover, the coal pile will be oriented and shaped to minimize wind erosion. Due to the moisture content maintained by rainfall and water spraying, the use of chemical stabilizers and dust suppressants are not warranted, and EPA agrees that the proposed practices and equipment represent BACT for PM from coal handling equipment.

Fugitive emissions from limestone handling will be controlled in a similar fashion through enclosure and water spraying. Transfer points and conveyors will be enclosed. Moreover, the receiving hopper/conveyor, transfer points and day silos will be maintained at negative pressures with an exhaust system(s) venting to a bag filter(s) or wet scrubber(s). The two separate systems, silos and hopper/transfer conveyors, will emit a maximum of 0.05 and 0.65 lb/hr, respectively.

The flyash handling system including transfer and storage silo will exhaust through a bag filter. The emission rate will not exceed 0.2 lb/hr. The technologies and emission rates proposed by the applicant are accepted as BACT for PM for the limestone and flyash handling systems.

3. Nitrogen Oxides (NOx) and Carbon Monoxide (CO)

The applicant proposes to use combustion controls to guarantee a maximum NO_x emission rate of 0.6 lb/MMBtu (2598 lb/hr) and CO of 0.014 lb/MMBtu (62 lb/hr). This is equivalent to the NO_x limit required in the NSPS for steam generating stations firing bituminous coal and the CO emission rate proposed by the applicant. The CO emission limit is considerably less than that predicted by the appropriate AP-42 factor of about 200 lb/hr (see Table 1.1-2). An attachment to this preliminary determination summary specifies combustion control requirements to balance the tradeoffs between NO_x and CO emissions through the use of a flue gas oxygen or CO_2 monitor. BACT for NO_x is low excess air firing and the use of staged combustion to maintain minimum NO_x emissions with a maximum as stated above. BACT for CO is proper combustion controls with a maximum emission rate as discussed above. The CO technology is maintained by the oxygen or CO_2 monitor. In addition, emissions of NO_x will be continuously monitored and recorded. EPA accepted the proposed emissions limits and technologies discussed as BACT for CO and NO_x for the proposed boiler.

B. Air Quality Analysis

The applicant has evaluated the modification's air quality impacts and their effects on NAAQS and maximum allowable increment. The maximum air quality impacts (highest, second highest concentrations) were estimated using EPA UNIMAP models and 5 years of meteorological data from Tampa International Airport. Annual average concentrations were estimated with AQDM-Briggs. Short-term modeling (24-and 3-hour averages) were estimated by first screening 5 years of meteorological data to identify the 24-hour (TSP and SO_2) and 3-hour periods (SO_2) which caused maximum impacts from the proposed modification. Second, CRSTER was used to locate general areas of maximum impacts (1.0 kilometer grid). Finally, maximum short-term concentrations were refined to 0.1 kilometer grid spacing using the PTMTPW model.

Review of the maximum predicted impacts from Unit 4 (see Table 2) shows the modification to have insignificant impacts for PM, NO_x and CO. Further, the maximum impacts of PM and SO_2 on nearby non-attainment areas (SO_2 - Pinellas County at about 55 km and PM - Tampa area at 5.3 km) are below the significance values defined in the Preamble to 40 CFR 52.21. Because non-attainment air quality is not significantly impacted, the modification is not subject to LAER or offset requirements. In addition, detailed analysis of PM, NO_x and CO is not required on the basis that impacts do not pose a threat to the NAAQS or available increment and no Class I area is impacted, as discussed below. Only emissions of SO_2 must be analyzed in detail to evaluate NAAQS and increment impacts.

It should be noted that the modeling did not consider PM emissions from the coal and limestone storage and handling facilities or other fugitive emissions sources, consistent with EPA Region IV policy. EPA Region IV does not require modeling of fugitive sources of this type for applications determined to be complete prior to August 7, 1980. Also, the applicant demonstrated that the stack height does not exceed good engineering practice or require consideration of downwash effects in the air quality analysis.

1. Increment Analysis

The applicant evaluated the impact on available SO_2 increment consistent with the requirements of 40 CFR 52.21 (k). The analysis considered all increment consuming sources located within a 50 km radius of the proposed construction site. Minor sources (<100 T/Y) within a 15 km radius and major sources within 50 km were modeled in determining maximum impacts.

In identifying sources for use in the increment and NAAQS analysis (discussed later) the applicant utilized the NEDS emissions data storage system and FDER air permit file system. Increment consuming sources were identified according to the definition of baseline in 40 CFR 52.21(b). Non-baseline emissions consume increment. An update to the original source list to account for sources permitted between the original search date and the PSD application complete date (about 1 year) identified several additional sources, none of which, however, affected the conclusions of the analysis.

It should be noted that previous emissions reductions at TECO Big Bend (units 1 - 3), at Gardinier, and at a number of other Tampa area sources have occurred which has expanded available increment. Most notable of these are the TECO Big Bend SO_2 reductions made to comply with revised SIP limits. The allowable emissions history of units 1 - 3 are as follows:

	Allowable Emissions Cap for Units 1-3 Collectively (Tons per Hour)		Total Cumulative Increment Expanding Emissions Reduction (Tons per Hour)
	3-Hour Average	24-Hour Average	
Original Limits	39.5	39.5	-
April 7, 1977	35	32	-
October 1, 1977	35	25	7
September 7, 1980	31.5	25	7

The reduction in 24-hour average emissions on October 1, 1977 constitutes a post January 6, 1975 emissions reduction due to construction at a major stationary source which expands increment. Baseline emission rates for Big Bend units 1-4 used as input to the increment analysis were based on actual operating data. Short-term emission rates (3-hour and 24-hour) were consistent with the allowable rates at full load. Annual emissions, however, were based on about two-thirds capacity operation which was experienced by units 1-3 in 1977. In addition, short-term impacts, under 50 and 75 percent load conditions, were evaluated to ensure identification of maximum impacts, which for power plants can occur at reduced loads due to bouyancy and momentum effects on plume rise.

The analysis involved two model runs for each averaging time and wind direction/meteorological data scenario investigated. In one run all new and modified sources were modeled at allowable emission rates. The source list included all new major sources commencing construction after January 6, 1975 and all new or modified minor sources (<100 T/Yr) commencing construction after August 7, 1977. The second run predicted impacts from all modified sources at their estimated premodification actual emission rates. The results of subtracting the impacts from the runs on a receptor by receptor basis were assumed by the applicant to approximate increment consumption.

The modeling results for the SO_2 annual averaging period show no positive values. The premodification concentration exceeded the projected impact from all new and modified sources at all receptors. Moreover, the projected maximum annual SO_2 impact from new and modified sources alone, without subtracting the premodification model run results, does not exceed the annual SO_2 increment (9.0 ug/m^3 impact vs 19 ug/m^3 increment). The analysis clearly demonstrates that the annual SO_2 increment will not be violated.

Results for the short term (3-hour and 24-hour) increment analysis were developed in a similar fashion. However, the premodification emission rates for Big Bend Units 1-3 were modeled at allowable emission rates (full capacity) which was indicative of worst case, short-term operation. The 24-hour results obtained from subtracting model runs again showed no positive values. The 3-hour results however show a net positive SO_2 impact of 67.7 ug/m^3.

The meteorological periods (3-hour and 24-hour) which caused maximum impact for TECO, as identified by the CRSTER model, had wind directions such that no significant interaction with other sources occurred (winds from the west and east). For this reason, several meteorological periods for which source interaction could occur were modeled. This modeling showed very little contribution to ground level concentrations in the vicinity of Big Bend relative to the contribution from Big Bend from interacting sources. The results of this modeling were incorporated into the overall estimated net impacts on 3-hour and 24-hour SO_2 increment, discussed previously.

The results of the increment analysis are listed in Table 3. The analysis is accepted by EPA as adequate demonstration that the available SO_2 increment will not be violated by the proposed modification.

2. NAAQS Impact

In evaluating maximum SO_2 ambient air quality impacts the applicant modeled all existing sources in conjunction with the proposed Unit 4. As indicated in the increment analysis, maximum short-term impacts due to interactions with other existing sources were evaluated but found to be less than the maximum impact from TECO Big Bend sources alone. The NAAQS modeling results are listed in Table 4. Assuming a background value of 20 ug/m^3 to account for natural sulfur dioxide sources (swamps, etc.) and long range SO_2 transport, the maximum predicted impacts in conjunction with background remain below the NAAQS levels (See Table 4). Since this application was determined to be complete prior to August 7, 1980, therefore subjecting the modification to the 1978 monitoring requirements (40 CFR 52.21(m); June 19, 1978) and the location is rural with only a small number of large sources, the approach described above is acceptable.

On the basis of the results of the air quality analysis the applicant proposes and EPA agrees that adequate demonstration has been made that NAAQS levels will not be violated. However, to verify these results the applicant will be required to perform continuous SO_2 ambient air quality monitoring for a period of at least 1 year following start-up of Unit 4.

C. Class I Area Impacts

The proposed construction site for Unit 4 is about 90 km from the Chassahowitzka National Wildlife Refuge. Impacts on this Class I area have been evaluated to ensure that the proposed modification does not degrade the Class I area air quality beyond allowable increments. As discussed previously, allowable emissions reductions since August 7, 1977 at Big Bend Units 1-3 more than offset the increased emissions from the proposed Unit 4 for short-term averages (3-hour and 24-hour). Moreover, a number of sources in the vicinity of Big Bend have similarly reduced emissions of SO_2. For this reason, the proposed construction is not expected to endanger the available SO_2 Class I increment.

Emissions of PM have been modeled and shown not to cause impacts in excess of the significance levels (Preamble 40 CFR 52.21). Although these significance levels do not apply to Class I areas, the additional dilution incurred over the 90 km distance between Big Bend and the Class I area,

NO_x and CO do not pose a threat to Class I air quality. The results of this analysis will be transmitted to the Federal Land Manager responsible for this Class I area for comments on the significance of the impacts.

D. Growth Impacts

It is anticipated that an average of 510 construction workers (craft and nonmanual) will be required per year during the 3-year Unit 4 construction period. A peak of approximately 1,100 personnel is expected during a 4-month period in 1984, the third year of construction. Based on TECO observations and labor availability surveys from construction of the previous three Big Bend units, approximately 90 percent of the construction work force will be hired from within the Tampa area work force. It is, therefore, reasonable to assume that no special provisions for housing, education, or community facilities will be necessary.

Unit 4 will provide electricity for general private, commercial and industrial consumption in central Florida. In this way, it will facilitate commercial and industrial growth. However, no acute air pollution effects are expected from this growth due to the gradual widespread nature of the anticipated development.

E. Additional Impacts on Soils, Vegetation and Visibility

The applicant has evaluated effects on soils, vegetation and visibility consistent with the provisions of 40 CFR 52.21(o). Tomatoes are the primary commercial crop in the vicinity of Big Bend. No unusually valuable or sensitive ecosystems have been identified. Supported by the analysis showing that ambient air quality will not exceed NAAQS levels which are set with a margin of safety to ensure protection of public health and welfare, no significant adverse effects to soils, vegetation and visibility are expected. In addition, the State of Florida has adopted ambient air quality standards (which the proposed modification is not expected to violate) which provide an additional margin of safety over the Federal standards. Moreover, opacity from Unit 4 will be limited to 20 percent). On this basis, the applicant feels that the proposed modification poses no threat to the area's soils, vegetation or visibility. These same factors coupled with a 90 km distance apply to the Chassahowitzka Class I area which is not expected to be adversely affected.

V. Conclusion

EPA proposes a preliminary determination of approval with conditions for construction of the proposed steam electric generating station, PSD-FL-040, based upon the application dated September 21, 1979 and the additional information dated November 8, 1979, January 18, 1980, February 29, 1980 and July 8, 1980. The preliminary determination of approval is contingent upon the following conditions:

1. The proposed steam generating station shall be constructed and operated in accordance with the capabilities and specifications of the application including the 417 megawatt net generating capacity and the 4330 MMBtu/hr heat input rate.
2. Emissions shall not exceed the allowable emission limits listed in Table 5 for SO_2, NO_x, PM, and CO.
3. Compliance with the boiler allowable emission limits required in Condition 2 will be demonstrated with performance tests conducted in accordance with the provisions of 40 CFR 60.46a, 48a and 49a, including applicable test methods, sampling procedures, sample volumes, sampling periods, etc. Compliance with opacity limits on the limestone and flyash handling system baghouse, the limestone day silos and the flyash silos will be determined with EPA reference method 9 (Appendix A, 40 CFR 60). These facilities are exempted from mass emission rate compliance tests unless opacity limits are exceeded or the Administrator (or his representative) otherwise determines that such performance testing is required. All facilities will operate within 10 percent of maximum operating capacity during performance tests.
4. The applicant will install and maintain continuous monitoring and recording opacity meter, sulfur dioxide and nitrogen oxide analyzers, oxygen and/or CO_2 analyzer in accordance with the provisions of 40 CFR 60.47a.

5. The following requirements will be met to minimize fugitive emissions of particulate from the coal storage and handling facilities, the limestone storage and handling facilities, haul roads and general plant operations:

   a. All conveyors and conveyor transfer points will be enclosed to preclude PM emissions excepting the coal handling stacker reclaimer, the tail end conveyor feeding the tripper and the barge unloading belt which are exempted for feasibility considerations;

   b. Coal storage piles will be shaped, compacted and oriented to minimize wind erosion;

   c. Water sprays for storage piles, handling equipment etc., including the handling equipment exempted from the conveyor enclosure requirement, will be applied during dry periods and as necessary to all facilities to maintain opacity (determined with reference Method 9) below 20 percent;

   d. The limestone handling receiving hopper, conveyor transfer points and day silos will be maintained at negative pressures with the exhaust vented to a control system(s); and

   e. The flyash handling system (including transfer and silo storage) will be maintained at negative pressures and vented to a control system.

6. The applicant will perform post-construction continuous ambient monitoring of sulfur dioxide emissions in accordance with EPA Region IV policies and procedures and the guidance offered in "Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/2-78-019, May 1978 and the quality

assurance procedures of 40 CFR 58 Appendix B. Such monitoring will be continued for a period of at least 1 year and until determined by the Administrator (or his representative) that the effects of the modification on ambient air quality have been quantified.

7. The applicant will comply with all requirements and provisions of the New Source Performance Standard for electric utility steam generating units (40 CFR 60 Part Da). In addition, the applicant must comply with the provisions and the requirements of the attached General Conditions.

8. While Tampa Electric Company has complied with the regulations entitling them to this PSD permit (40 CFR 52.21), this does not constitute an environmental endorsement of this permit nor does it in any way prejudge or predetermine the ongoing EIS review.

9. If it is determined through the NPDES permitting process or related EIS review, that cooling towers would be required for the construction and operation of the facility at this location, this permit would be revoked and a complete new application would be required addressing all new emissions and subsequent requirements for this new plant configuration.

10. The applicant must submit to EPA Region IV's Consolidated Permits Branch within five (5) working days after it becomes available, copies of all technical data pertaining to the selected control devices, including formal bids from vendors, guaranteed efficiencies or emission rates. Although the type of control equipment described in the application has been determined by EPA to be adequate, EPA may, upon review of the data, disapprove the application if EPA determines the selected devices to be inadequate to meet the emission limits specified in this conditional approval.

11. The applicant shall maintain records of all coal washing and preparation activities, as necessary, to ensure a minimum of 25% sulfur removal from any coal which is to be fired in Big Bend Unit No. 4. These reports shall be submitted to EPA on a quarterly basis.

GENERAL CONDITIONS

1. The permittee shall notify the permitting authority in writing of the beginning of construction of the permitted source within 30 days of such action and the estimated date of start-up of operation.

2. The permittee shall notify the permitting authority in writing of the actual start-up of the permitted source within 30 days of such action and the estimated date of demonstration of compliance as required in the specific conditions.

3. Each emission point for which an emission test method is established in this permit shall be tested in order to determine compliance with the emission limitations contained herein within sixty (60) days of achieving the maximum production rate, but in no event later than 180 days after initial start-up of the permitted source. The permittee shall notify the permitting authority of the scheduled date of compliance testing at least thirty (30) days in advance of such test. Compliance test results shall be submitted to the permitting authority within forty-five (45) days after the complete testing. The permittee shall provide (1) sampling ports adequate for test methods applicable to such facility, (2) safe sampling platforms, (3) safe access to sampling platforms, and (4) utilities for sampling and testing equipment.

4. The permittee shall retain records of all information resulting from monitoring activities and information indicating operating parameters as specified in the specific conditions of this permit for a minimum of two (2) years from the date of recording.

5. If, for any reason, the permittee does not comply with or will not be able to comply with the emission limitations specified in this permit, the permittee shall provide the permitting authority with the following information in writing within five (5) days of such conditions:

   (a) description of noncomplying emission(s),

   (b) cause of noncompliance,

   (c) anticipated time the noncompliance is expected to continue or, if corrected, the duration of the period of noncompliance,

   (d) steps taken by the permittee to reduce and eliminate the noncomplying emission,

   and

   (e) steps taken by the permittee to prevent recurrence of the noncomplying emission.

   Failure to provide the above information when appropriate shall constitute a violation of the terms and conditions of this permit. Submittal of this report does not constitute a waiver of the emission limitations contained within this permit.

6. Any change in the information submitted in the application regarding facility emissions or changes in the quantity or quality of materials processed that will result in new or increased emissions must be reported to the permitting authority. If appropriate, modifications to the permit may then be made by the permitting authority to reflect any necessary changes in the permit conditions. In no case are any new or increased emissions allowed that will cause violation of the emission limitations specified herein.

7. In the event of any change in control or ownership of the source described in the permit, the permittee shall notify the succeeding owner of the existence of this permit by letter and forward a copy of such letter to the permitting authority.

8. The permittee shall allow representatives of the State environmental control agency and/or representatives of the Environmental Protection Agency, upon the the presentation of credentials:

   (a) to enter at reasonable times upon the permittee's premises, or other premises under the control of the permittee, where an air pollutant source is located in which any records are required to be kept under the terms and conditions of the permit;

   (b) to have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit, or the Act;

   (c) to inspect at reasonable times any monitoring equipment or monitoring method required in this permit;

   (d) to sample at reasonable times any emission of pollutants;

   and

   (e) to perform at reasonable times an operation and maintenance inspection of the permitted source.

9. All correspondence required to be submitted by this permit to the permitting agency shall be mailed to the:

   Chief, Consolidated Permits Branch
   Enforcement Division
   U.S. Environmental Protection Agency
   Region IV
   345 Courtland Street
   Atlanta, GA 30365

10. The conditions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

The emission of any pollutant more frequently or at a level in excess of that authorized by this permit shall constitute a violation of the terms and con- of this permit.

TABLE 1
Emissions Summary

Pollutant	Significant Emissions Rate (tons/yr)	Potential Emissions[a] (tons/yr)
SO_2	40	14,603
PM	25	573[b]
NO_x	40	11,379
CO	100	267
VOC	40	9
Lead	0.6	c
Asbestos	0.007	c
Beryllium	0.0004	c
Mercury	0.1	c
Fluorides	3.0	c
Other	-	c

[a] Based on continuous maximum capacity operations and equal to the allowable emission rates specified in the conclusions section.

[b] Includes emissions from the boiler, the flyash system, and the coal and limestone handling systems.

[c] Emissions of lead and non-criteria regulated pollutants do not exceed 50 tons per year and are not subject to regulations under the State Implementation Plan or 40 CFR Part 60 and 61 for this source. For this reason, no PSD review requirements apply to these pollutants and detailed emissions estimates were not required.

Table 2

MAXIMUM AIR QUALITY IMPACTS (ug/m3)

	Averaging Time							
	Annual			24-Hour		8-Hour	3-Hour	1-Hour
	PM	SO_2	NO_x	PM	SO_2	CO	SO_2	CO
Boiler (Big Bend Unit 4)	<<1	1.0	0.5	0.9	34.2	<8[a]	163	<2000[a]
A. Limestone and Flyash Handling Systems (max. at distance of 0.3 km)[b]	0.33			4.11				
B. Boiler Maximum Impact at 0.5 km	negl.			0.001				
Combined maximum (A & B)	0.33			4.111				
Maximum Impact on Nonattainment Areas[c]	<<1	<<1		0.4	4.0		17.0	
Significance Levels	1	1	1	5	5	500	25	2000

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[a] A 3-hour CO concentration of 8 ug/m^3 was estimated based on SO_2 short-term modeling results and a ratio of emission rates (CO/SO_2). Although the 1-hour concentration will exceed 8 ug/m^3, it will not exceed the significance level of 2000 ug/m^3.

[b] The limestone and flyash systems emissions were not modeled together with the boiler; however, maximum boiler contributions at 0.5 km (the shortest distance modeled) are combined as a conservative estimate to demonstrate that the modification as a whole is insignificant for PM. At 5km the handling system impact falls to below 0.13 (annual) and 0.9 (24-hour), thus insuring no significant interaction with the boiler.

[c] SO_2 non-attainment area - Pinellas County; PM non-attainment area - Hillsborough County (Tampa). This concentration was estimated based on a 1.2 lb/MMBtu emission rate for Unit 4.

Table 3

SO_2 INCREMENT IMPACTS [a]

	Averaging Time		
	Annual	24-Hour	8-Hour
Proposed Unit 4 (ug/m^3)	1.0	34.2	163
Proposed Unit 4 with Existing Units 1-3[b] (ug/m^3)	zero[b]	zero[b]	67.7
Unit 4 with All Interacting Sources (ug/m^3)	zero[b]	zero[b]	67.7
Allowable Increment (ug/m^3)	20	91	512

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[a] Note that the proposed modification had an insignificant TSP impact, and therefore, a TSP increment analysis was not required.

[b] A reduction in actual emissions from Units 1-3 and other sources in the area occurred in 1977, thus expanding available increment.

TABLE 4

SULFUR DIOXIDE NAAQS IMPACTS[a]

	Annual (ug/m^3)	24-Hour (ug/m^3)	3-Hour (ug/m^3)
Proposed Unit 4	1.0	34.2	163
All Interacting Sources (Including Unit 4)	18.5	185[b]	1,087[b]
Background	20	20	20
Total	38.5	205	1,107
NAAQS Ceiling	80	365	1,300

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[a] Unit 4 impacts of PM, NO_x and CO are insignificant and no detailed NAAQS analysis is required.

[b] Maximum impact occurs due to Units 1-4 only with a west to east wind. No other sources interact under these conditions.

TABLE 5

ALLOWABLE EMISSION LIMITS

	Facility	POLLUTANTS								
		SO_2		NO_x		PM		CO		
		lb/MMBtu	lb/hour	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	Opacity
1.	Unit 4 Boiler (4330 MMBtu/hr) Continuous Limit					0.03	130	0.014	61	20%[a]
	30 Day Rolling Average	0.82	3576	0.6	2598					
2.	Limestone and Handling System Baghouse						0.65[b]			5%
3.	Limestone Day Silo						0.05[b]			5%
4.	Flyash Silos and Handling System						0.2[b]			5%

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[a] Not to be exceeded for more than one six minute period per hour and never to exceed 27 percent opacity.

[b] Exempt from compliance testing provided opacity limit is maintained.

RESPONSE TO COMMENT

TAMPA ELECTRIC COMPANY

(PSD-FL-040)

One letter of comment was received during the public comment period for Tampa Electric Company's (TECO) proposed electric generating unit (Big Bend Unit 4). The Public Notice was published December 31, 1980. Due to a substantial error in the BACT evaluation for the SO_2 emission limit, EPA has decided to issue this revised Preliminary Determination for public comment prior to a Final Determination. A summary of the substantive comments received and EPA Region IV responses are as follow:

Comment 1:

The commenter pointed out that the basis for the SO_2 allowable emission limit included in the Preliminary Determination was in error and that the resulting limit (0.63 lb/MMBtu) was too restrictive.

Response 1:

Following reevaluation of the application and review of the additional information submitted with the comments, EPA concludes that the data in the application was misinterpreted in developing the SO_2 allowable emissions limit in the original Preliminary Determination. In response to the comment, EPA has reevaluated the SO_2 BACT analysis and determined an SO_2 allowable limit (0.82 lb/MMBtu), based on the higher end of a proposed allowable range contained in an addendum to the application.

Comment 2:

The commenter was concerned that water spraying of the coal pile and drop points, as proposed in the application, was required during all dry and high wind periods, second that water spraying of the limestone was unnecessarily required, and third that enclosed limestone conveyors need not be exhausted to a control system.

Response 2:

The applicant is required, as specified in Condition 5c. to utilize water sprays during dry periods to maintain opacity of all fugitive sources below 20 percent. Compliance with this condition of approval does not necessarily require water spraying during all dry periods or periods of high wind. Neither does it mandate water spraying of limestone. If the limestone storage pile is enclosed, as specified in the comments, it likely will not require spraying. With respect to the comment on transfer conveyor exhaust, the language of the Preliminary Determination was somewhat misleading. The intent was to require exhaust and control of conveyor transfer points, (as proposed in the application). The matter has been clarified in this Preliminary Determination.

Comment 3:

The commenter feels that use of a flue gas oxygen meter to balance CO and NO_x emissions from a utility boiler is not practical or feasible due to variations in the allowable O_2 range with boiler load and with the properties of the coal being fired.

Response 3:

EPA acknowledges the commenter's concerns here and has therefore revised this permit providing TECO the option of either monitoring for O_2 or CO_2. EPA will consider either choice as being an effective means of balancing NO_x and CO emission tradeoffs in order to satisfy this particular permit requirement.

Comment 4:

The commenter feels that the SO_2 post-construction monitoring requirement is unjustified.

Response 4:

In as much as the proposed new source will be increasing SO_2 emissions into the Big Bend region by as much as 12,000 tons per year and existing ambient air monitoring data at 4 of the 5 stations in the vicinity show concentrations in excess of 50 percent of the SO_2 NAAQS, EPA maintains the post-construction SO_2 monitoring requirement to establish the impact of the new source on existing ambient air quality.

Comment 5:

The commenter objected to the requirement for monitoring of the pH in the FGD system as unreasonable.

Response 5:

Upon reevaluation of the proposed FGD control instrumentation, EPA agrees that redundant scrubber inlet and exit SO_2 analyzers provides sufficient assurance that compliance of the SO_2 emissions limit should be maintained.

Comment 6:

The commenter questioned the requirement to submit a new PSD permit if the design of the system is modified to include brackish water cooling towers.

Response 6:

As stated by Region IV new source review staff in a meeting with TECO regarding the environmental impact statement, the addition of the cooling towers (PM emitting sources) to the proposed construction would necessitate resubmittal of the PSD application. The air quality analysis, particularly with respect to fugitive PM emissions, would be in question. In addition, the modification would be regarded as a significant modification to the plant design proposed for PSD preconstruction review.

Comment 7:

The commenter requested clarification on the degree of detail necessary for FGD system design parameters required for submittal and was concerned about confidentiality of certain materials.

Response 7:

The required submittal is not meant to be exhaustive or time consuming; however, sufficient detail on scrubber and ESP design (liquid/gas flow characteristics, capacity, controls, performance guarantees etc.) should be submitted to allow a determination on whether or not the unit can achieve the required control levels. The application discusses only "generic" control systems. Integral to this discussion is the characteristics of the selected coal. As to confidentially of submitted materials, any such materials contained in the submittal should be clearly marked. Confidential materials will be maintained in a separate locked file and its review will be restricted to the engineer(s) responsible for evaluating system design. Other individuals and the general public will not be afforded direct access to the materials.

This Preliminary Determination takes into consideration the comments and responses discussed previously and additional minor comments included in the same submittal. A copy of the comments received have been appended to the Preliminary Determination and will be placed on display in the same location as the original Preliminary Determination for public information

TECO
TAMPA ELECTRIC COMPANY

POST OFFICE BOX 111 TAMPA, FLORIDA 33601 TELEPHONE (813) 879-4111

January 28, 1981

Mr. Tommie A. Gibbs, Chief
Air Facilities Branch
United States Environmental
Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30308

RE: Tampa Electric Company
Big Bend Station - Unit 4
PSD Application #PSD-FL-040

Dear Mr. Gibbs:

We have reviewed the Big Bend Unit 4 PSD Application Preliminary Determination and are submitting the attached comments. These comments are presented in a format and sequence similar to that of the Preliminary Determination.

As discussed with EPA representatives on January 14, 1981, we are most concerned with the calculated 30 day rolling average SO_2 limitation and specific conditions 5,7 and 8. Our comments with respect to these major items as well as numerous other items are provided within.

Should you have any questions regarding this matter, please contact Mr. Jerry Williams, Manager, Environmental Planning.

Sincerely,

Alex Kaiser
Vice President-Energy Supply

attachment

TAMPA ELECTRIC COMPANY COMMENTS ON THE PSD - FL - 040 APPLICATION PRELIMINARY DETERMINATION

II. LOCATION

o Page 1

The northern and southern property boundaries are not Big Bend Road and U.S. Highway 41. The site is located west of Highway 41 with plant properties both north and south of Big Bend Road.

III. PROJECT DESCRIPTION

o Page 1

Big Bend Unit 4 will have a net generating capacity of 417 MWe. The gross generating capacity will be 486 MWe. The maximum heat input rate is 4330 million BTU's per hour.

Coal washing facilities at the generating site were not included as part of the application and are not planned for Big Bend Station. The coal will be washed prior to delivery to Big Bend Station.

o Page 2

Due to the as-received moist nature of the limestone to be utilized at Big Bend Station and the rainfall amounts throughout the year, the limestone will be stored within a building.

IV. SOURCE IMPACT ANALYSIS

A. Best Available Control Technology Analysis (BACT)

1. Sulfur Dioxide Emissions Control

o Page 3

Five percent of the potential SO_2 Emissions are expected to remain in the ash.

o **Pages 3 and 4**

The calculated thirty day rolling average emission limitation of 0.63 lbs./MMBTU was based on fuel F-2B, a fuel utilized in specifying the Flue Gas Desulfurization (FGD) system. As noted on page 4-12 of Volume 2 in the application, the fuel quality analysis presented for fuel F-2B reflected a 25% removal of potential SO_2 emissions due to coal washing.

EPA concluded in the determination that 90% reduction in potential SO_2 emissions resulting from 25% removal by washing, 5% retention in the ash, and 86% removal by the FGD system constituted BACT. However, in calculating the SO_2 limitation based on the 90% removal criteria, EPA failed to recognize the washed condition of the coal. The EPA calculations are as follows:

Uncontrolled SO_2 emissions	6.30 lbs./MMBTU	
Emissions after washing	4.72 lbs./MMBTU	90% Removal
Emissions after 5% ash retention	4.50 lbs./MMBTU	
Emissions after FGD system	0.63 lbs./MMBTU	

EPA began their 90% removal calculations with an uncontrolled SO_2 emission rate of 6.3 lbs.MMBTU which is actually an emission rate after coal washing. Thus, a 25% removal from coal washing was calculated twice. The calculations should have been made as follows:

Uncontrolled SO_2 emissions	8.40 lbs./MMBTU	
Emissions after washing	6.30 lbs./MMBTU	90% Removal
Emissions after 5% ash retention	6.00 lbs./MMBTU	
Emissions after FGD system	0.84 lbs./MMBTU	

The correct emission limitation is 0.84 lbs./MMBTU. The 0.63 lbs./MMBTU calculated by EPA reflects an overall reduction in potential SO_2 emissions of 93%.

At the request of EPA, TECO submitted a proposed 30 day rolling average SO_2 emission limitation range of 0.77 to 0.82 lbs./MMBTU. This information was submitted based on data provided by the potential coal suppliers for Big Bend Unit 4. This value range is consistent with and below the above calculated emission limit of 0.84 lbs./MMBTU. EPA, however, rejected the TECO proposal as too high an emission limit and has required the incorrectly calculated emission limit of 0.63 lbs./MMBTU.

2. PARTICULATE MATTER (PM)

o Page 5

It is noted that during dry periods and high winds, water spraying of the coal pile and all drop points is required. It was proposed in the application that water spraying be utilized, for fugitive emissions control during high winds and dry periods. However, these techniques are not necessary control measures during all dry and high wind periods. When weather conditions that may require water spraying for fugitive emissions control are anticipated, arrangements are made for the services of a water tank truck.

The limestone to be utilized by the Unit 4 FGD System will be very moist. To avoid additional moisture from precipitation, the limestone storage pile will be enclosed within a building. Due to the moist, as-received, nature of the limestone, water spraying will not be necessary. The limestone conveyors will be covered or enclosed but venting to a control device is not necessary and has never been proposed. As noted in the application, the rail car/truck unloading facilities and the limestone day silos will be provided with exhaust systems venting to bag filters.

3. NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO)

o Page 5

An attachment to the Preliminary Determination specifies combustion control requirements to balance the tradeoffs between NO_x and CO emissions through the use of a flue gas oxygen monitor. This technique is not considered practical or feasible for a utility boiler. Big Bend Unit 4 and other utility boilers incorporate flue gas oxygen analyzers for proper control of combustion. For a specific design coal, boiler excess oxygen will range from a high value at low operational load to a low value at maximum design capacity. Even these values are fine tuned by the boiler operator for proper steam temperature and are affected by combustion air temperature and other boiler conditions. As the coal (and its carbon content) change, the excess oxygen requirements change over the various load conditions. Therefore, if some maximum excess oxygen value is used for one coal to control NO_x, another coal may still comply with NO_x limits even though the excess oxygen value is higher than the set limit. These values also change at low loads for different coals and boiler conditions and apply in the same manner to CO compliance. During startups, shutdowns and load changes, it would be normal for the excess oxygen to vary outside of the set range while still being in compliance. Note that there will be a continuous monitor for showing compliance with NO_x emission limits. The excess oxygen analyzer is not load dependent; it is used for boiler combustion control and can not be reasonably used for CO and NO_x emission limit control based on some specific coal or operational condition.

A. Air Quality Analysis

1. Increment Analysis

o Page 7

In the last paragraph, third line "... area source has occurred..." should be "... area sources have occurred..."

2. NAAQS Impact

o Page 10

It is noted in the preliminary determination that the applicant proposes and EPA agrees that an adequate demonstration has been made that NAAQS level will not be violated. However, the EPA will require continuous SO_2 monitoring by the applicant to verify the results of the analysis. Guidelines for when post construction monitoring should be required are provided on Page 4, Section 2.1.2 of Ambient Monitoring Guidelines For Prevention of Significant Deterioration (PSD), EPA - 450/4-80-012, November 1980 and are as follows:

> ### 2.1.2 Criteria Pollutants -Postconstruction Phase
>
> EPA has discretion in requiring postconstruction monitoring data under section 165 (a)(7) of the Clean Air Act and in general will not require postconstruction monitoring data. However, to require air quality monitoring data implies that the permit granting authority will have valid reasons for the data and, in fact, will use the data after it is collected. Generally, this will be applied to large sources or sources whose impact will threaten the standards or PSD increments. Examples of when a permit granting authority may require postconstruction monitoring data may include:
>
> a. NAAQS are threatened - The postconstruction air quality is projected to be so close to the NAAQS that monitoring is needed to certify attainment or to trigger appropriate SIP related actions if nonattainment results.
>
> b. Source impact is uncertain or unknown - Factors such as complex terrain, fugitive emissions, and other uncertainties in source or emission characteristics result in significant uncertainties about the projected impact of the source or modification. Postconstruction data is justified as a permit condition on the basis that model refinement is necessary to assess the impact of future sources of a similar type and configuration:

It is felt that the Big Bend situation does not fit these guidelines for required postconstruction modeling. The predicted ambient air quality impacts do not threaten NAAQS or PSD increments. The preconstruction ambient air monitoring data provided in the application indicate that the SO_2 ambient air quality in the site vicinity does not approach AAQS except for one reading at a particular station. On May 7, 1977, maximum 24 hour and 3 hour values representing 90% of the respective standard were recorded. However, since that time SO_2 emissions from Big Bend have been reduced by 3.5 tons per hour on a 3-hour average and by 7 tons per hour on a 24-hour average. In addition, the SO_2 ambient air quality data indicate that no other reading exceeded 80% of the standard with the arithmetic mean concentrations not exceeding 30% of the applicable standard. Therefore, based on the EPA guidelines, the ambient air monitoring data, and the Big Bend emission reductions, the requirement for postconstruction monitoring is not justified.

C. Class I Area Impact

o Page 10

In the last paragraph, fourth line, distance is misspelled.

D. Growth Impacts

o Page 11

Based on surveys and previous construction at Big Bend, approximately 90 percent of the construction workers will be hired from within the Tampa area work force.

V. CONCLUSION

o Page 12

#1 As previously noted, Big Bend 4 will have a gross generating capacity of 486 MW_e with a net generating capacity of 417 MW_e. The maximum heat input rate is 4330 MMBTU/HR.

#3 In the last sentence, it is believed opacity should be capacity.

#5 As previously noted, compliance with the condition "Use of Flue Gas Oxygen Meter as BACT for combustion controls" is not considered feasible or pratical.

#6c As previously noted, water spraying will not be provided for limestone handling and storage.

#6d As previously noted, it is unnecessary for the limestone conveyors to be maintained at negative pressures with the exhaust vented to a control system.

#7 While the effluent pH of some FGD systems may provide an indication of SO_2 removal efficiency, such is not the case for the Big Bend Unit 4 system.

The FGD System that Tampa Electric Company has purchased is a limestone based two loop process which produces a gypsum by-product. Control of reagent addition is by an SO_2 mass flow signal. The inlet and outlet SO_2 values are compared, controlling the SO_2 removal efficiency to the setpoint (i.e. 86%) removal. In the two loop process, the first loop operates at a low pH for production of gypsum and some SO_2 removal, while the second loop operates at high pH for dissolution of limestone and the major amount of SO_2 removal. It is possible for the system to meet the required SO_2 removal efficiency while the pH in any one loop is less than it was at some other time for the same overall SO_2 removal. This is because of the two independent loops. While pH is monitored, it is not a direct control value and should not be used as such. Therefore, it is not reasonable to maintain or require a minimum pH value in this system.

#8 As noted, earlier, the need for post construction monitoring is not warranted.

#11 It is not clear why a complete new application would be necessary if cooling towers were required for the facility. The use of cooling towers would have no effect on the information in the application as submitted to date. It would be more reasonable to require that the additional necessary information and analyses due to cooling tower operation be submitted if towers are to be utilized. Then the permitting authority could make the proper changes in the permit conditions. This condition is redundant in light of general condition number 6.

#12 It is not clear as to what detail of technical data is required by the Agency. In addition, formal bids from vendors are considered confidential and are not available for reproduction and distribution.

GENERAL CONDITIONS

#1 & #2

The definitions of start of construction and start of operation are not clear. It is assumed that start of construction is the physical placement of facilities. Start of operation is assumed to mean the beginning of steady on-line commercial operation.

#8a This condition should include the wording ..."at reasonable times....", similar to items 8(b) through 8(e).

ATTACHMENT - "Use of flue gas oxygen meter as BACT for combustion controls"

As previously noted, this procedure is not practical or feasible and as written may constitute non-compliance when, in fact, all emission limitations are met.

Table 1 For the pollutant CO the potential emissions should be 267 Tons/Year.

Table 5 As previously noted the 30 day rolling average SO_2 emission limitation was calculated incorrectly.

In Item 2, flyash should not be included. The flyash handling system and flyash silos are vented to the same bag house. Flyash handling is included in the Item 4 emission rate of 0.2 lb./HR.

Appendix F

FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION DRAFT CONDITIONS OF CERTIFICATION FOR BIG BEND UNIT 4

State of Florida Department of Environmental Regulation
Tampa Electric Company
Big Bend Unit 4
PA 79-12
CONDITIONS OF CERTIFICATION (Revised 6-2-81)

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State of Florida Department of Environmental Regulation
Tampa Electric Company
Big Bend Unit 4
PA 79-12

CONDITIONS OF CERTIFICATION (Revised 6-2-81)

I. Air

The construction and operation of Big Bend Unit 4 at the Tampa steam electric power plant site shall be in accordance with all applicable provisions of Chapters 17-2, 17-4, 17-5 and 17-7, Florida Administrative Code. In addition to the foregoing, the permittee shall comply with the following conditions of certification:

A. Emission Limitations

1. Based on a maximum heat input of 4,330 million BTU per hour, stack emissions from Big Bend Unit 4 shall not exceed the following when burning coal:

   a. SO_2 - 1.2 lb. per million BTU heat input, maximum two hour average, 0.84 lb/MMBtu on a 30-day rolling average.

   b. NO_x - 0.60 lb. per million BTU heat input.

   c. Particulates - 0.03 lb. per million BTU heat input.

   d. Visible emissions - 20% (6-minute average), except one 6-minute period per hour of not more than 27% opacity.

2. The height of the boiler exhaust stack for Unit 4 shall not be less than 490 ft. above grade.

3. Particulate emissions from the coal handling facilities:

   a. The permittee shall not cause to be discharged into the atmosphere from any coal processing or conveying equipment, coal storage system or coal transfer and loading system processing coal, visible emissions which exceed 20 percent opacity. Particulate emissions shall be controlled by use of control devices.

   b. The permittee must submit to the Department within ten (10) working days after it becomes available, copies of technical data pertaining to the selected particulate emissions control for the coal handling facility. These data should include, but not be limited to, guaranteed efficiency and emission rates, and major design parameters such as air/cloth ratio and flow rate. The Department may, upon review of these data, disapprove the use of such device if the Department determines the selected control device to be inadequate to meet the emission limits specified in 3(a) above. Such disapproval shall be issued within 30 days of receipt of the technical data.

4. Particulate emissions from limestone and flyash handling shall not exceed the following:

   a. Limestone silos - 0.05 lb/hr.

   b. Limestone hopper/transfer conveyors - 0.65 lb/hr.

   c. Flyash handling system - 0.2 lb/hr.

5. Visible emissions from the following facilities shall be limited to 5% opacity: (a) limestone and flyash handling system, (b) limestone day silos and (c) flyash silos.

6. Compliance with opacity limits of the facilities listed in Condition 5 will be determined by EPA reference method 9 (Appendix A, 40 CFR 60).

7. Construction shall reasonably conform to the plans and schedule given in the application.

8. The permittee shall report any delays in construction and completion of the project to the Department's Southwest District Office.

9. Reasonable precautions to prevent fugitive particulate emissions during construction, such as coating of roads and construction sites used by contractors, will be taken by the permittee.

10. Coal should not be burned in the unit unless both electrostatic precipitator and limestone scrubber are operating properly.

11. Coal burned in the unit should be washed before it is transported to the plant site.

B. Air Monitoring Program

1. The permittee shall install and operate continuously monitoring devices for the Unit 4 boiler exhausts for sulfur dioxide, nitrogen dioxide, oxygen and opacity. The monitoring devices shall meet the applicable requirements of Section 17-2.08, FAC, and 40 CFR 60.47a. The opacity monitor may be placed in the duct work between the electrostatic precipitator and the FGD scrubber.

2. The permittee or Hillsborough county shall operate the two ambient monitoring devices for sulfur dioxide in accordance with EPA reference methods in 40 CFR, Part 53, and two ambient monitoring devices for suspended particulates. The monitoring devices shall be specifically located at a location approved by the Department. The frequency of operation shall be every six days commencing as specified by the Department.

3. The permittee shall maintain a daily log of the amounts and types of fuels used and copies of fuel analyses containing information on sulfur content, ash content and heating values.

4. The permittee shall provide sampling ports into the stack and shall provide access to the sampling ports, in accordance with DER publication, Standard Sampling Techniques and Methods of Analysis for the Determination of Air Pollutants from Point Source, July, 1975.

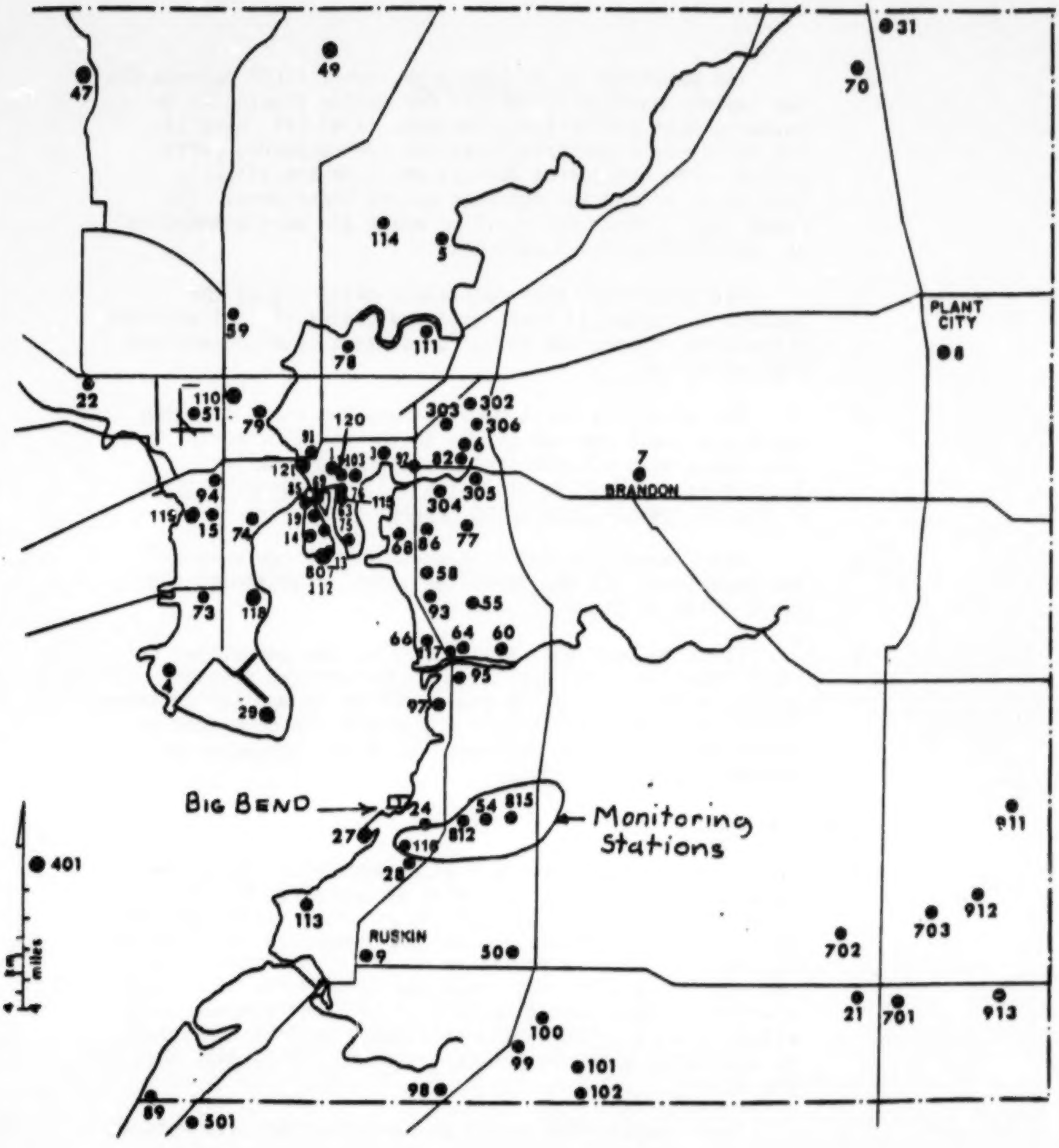
5. The ambient monitoring program may be reviewed by the Department and the permittee annually beginning two years after start-up of Unit 4.

6. Prior to operation of the source, the permittee shall submit to the Department a standardized plan or procedure that will allow the permittee to monitor emission control equipment efficiency and enable the permittee to return malfunctioning equipment to proper operation as expeditiously as possible.

C. Stack Testing:

1. Within 60 calendar days after achieving the maximum capacity at which each unit will be operated, but no later than 180 operating days after initial start-up, the permittee shall conduct performance tests for particulates SO_2, NO_x and visible emissions during normal operations near 4,330 MMBtu/hr heat input and furnish the Department a written report of the results of such performance tests within 30 days. The performance tests will be conducted in accordance with the provisions of 40 CFR 60.46a, 48a, and 49a.

2. Performance tests shall be conducted and data reduced in accordance with methods and procedures in accordance with DER's Standard Sampling Techniques and Methods of Analysis for Determination on Air Pollutants from Point Sources, July, 1975.



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AIR SAMPLING STATIONS
HILLSBOROUGH COUNTY, FLORIDA
1979

Figure I

3. Performance tests shall be conducted under such conditions as the Department shall specify based on representative performance of the facility. The permittee shall make available to the Department such records as may be necessary to determine the conditions of the performance tests.

4. The permittee shall provide 30 days prior notice of the performance tests to afford the Department the opportunity to have an observer present.

5. Stack tests for particulates and SO_2 shall be performed annually in accordance with conditions C. 2, 3, and 4 above.

D. Reporting

1. For Unit 4, stack monitoring, fuel usage and fuel analysis data shall be reported to the Department's Southwest District Office on a quarterly basis commencing with the start of commercial operation in accordance with 40 CFR, Part 60, Section 60.7., and in accordance with Section 17-2.08, FAC.

2. Utilizing the SAROAD or other format approved in writing by the Department, ambient air monitoring data shall be reported to the Bureau of Air Quality Management of the Department quarterly. Commencing on the date of certification, such reports shall be due by the last day of the month following the quarterly reporting period.

3. Beginning one month after certification, the permittee shall submit to the Department a quarterly status report briefly outlining progress made on engineering design and purchase of major pieces of equipment (including control equipment). All reports and information required to be submitted under this condition shall be submitted to the Administrator of Power Plant Siting, Department of Environmental Regulation, 2600 Blair Stone Road, Tallahassee, Florida, 32301.

II. Water Discharges

Any discharges into any waters of the State during construction and operation of Big Bend Unit 4 shall be in accordance with all applicable provisions of Chapter 17-3, Florida Administrative Code, and 40 CFR, 423, Effluent Guidelines and Standards for Steam Electric Power Generating Point Source Category, except as provided herein. Also, the permittee shall comply with the following conditions of certification:

A. Plant Effluents and Receiving Body of Water

For discharges made from the power plant the following conditions shall apply:

1. Receiving Body of Water (RBW)

The receiving body of water has been determined by the Department to be those waters of the Tampa Bay and any other waters affected which are considered to be waters of the State within the definition of Chapter 403, Florida Statutes.

2. Point of Discharge (P.O.D.)

The point of discharge will be determined by the Department to be where the effluent physically enters the waters of the State.

3. Thermal Mixing Zone

The instantaneous zone of thermal mixing for the cooling system shall not exceed an area of 4980 acres. The temperature at the point of discharge into the Tampa Bay shall not be greater than 109 degrees F. The temperature of the water at the edge of the mixing zone shall not exceed the limitations of Paragraph 17-3.05(1)(d). The permittee shall validate the size of this mixing zone by submission of a verified or calibrated thermal dispersion model at least six months prior to commencement of operation. The Department and TECO shall agree to a program for selecting, verifying and utilizing an appropriate model.

4. Chemical Wastes

All discharges of low volume wastes (demineralizer regeneration, floor drainage, lab drains and similar wastes) shall comply with Chapter 17-3. If violations of Chapter 17-3 occur, corrective action shall be taken. These wastewaters shall be discharged to an adequately sized and constructed treatment facility. Preoperational and operational metal cleaning wastes, low volume wastes, boiler fireside wash, air preheater wash, and stack wash shall be disposed of in an adequately sized percolation pond and spray irrigation facility.

5. Coal Pile

Coal pile runoff shall be disposed of in the wastewater treatment/spray irrigation system and shall not be directly discharged to surface waters.

6. Chlorine

The concentration of total residual chlorine discharged from Unit 4 shall not exceed 0.2 mg/l at the POD nor 0.01 mg/l beyond an instantaneous mixing zone of 6.1 acres. The condensers for Unit 4 shall not be chlorinated more than two hours per day and shall not be chlorinated simultaneously with any other unit.

7. pH

The pH of the combined discharges shall be such that the pH be within the range of 6.0 to 8.5.

8. Polychlorinated Biphenyl Compounds

There shall be no net discharge of polychlorinated biphenyl compounds.

9. FGD Chloride Bleedstream

The bleedstream from the FGD system shall be treated to control pH, turbidity, solids and toxic metals prior to discharge into the cooling water system. The following effluent limitations will apply:

Effluent	Daily Maximum	Maximum 30-Day Daily Average
TSS	100 mg/l	30 mg/l
Oil and Grease	20 mg/l	15 mg/l
pH	6-9	6-9

The design plans and specifications of the treatment system shall be submitted to the Department for review and approval prior to construction.

10. Boiler and Bottom Ash Sluice System Blowdown

Blowdown from the boiler and from the bottom ash sluice system shall be treated as appropriate prior to discharge to the cooling water system. The following effluent limitations shall apply:

Effluent	Daily Maximum	Maximum 30-Day Daily Average
TSS	100 mg/l	30 mg/l
Oil and Grease	20 mg/l	15 mg/l
pH	6-9	

TECO shall provide the dimensions of the bottom ash system settling pond and provide calculations demonstrating that sufficient residence time will be provided to achieve the above limitations.

11. Gypsum Storage Areas

There shall be no direct discharge of stormwater runoff to surface waters from the gypsum storage area.

12. Storm Water Runoff

During plant operation, necessary measures shall be used to settle, filter, treat or absorb silt-containing or pollutant-laden stormwater runoff to limit the suspended solids to 50 mg/l or less at the POD during rainfall periods less than the 10-year, 24-hour rainfall, and to prevent an increase in turbidity of more than 50 Jackson Turbidity Units above background in waters of the State beyond 150 meters from the POD at Station E 4500 and N 3712.

Control measures shall consist at the minimum of filters, sediment traps, barriers, berms or vegetative planting. Exposed or disturbed soil shall be protected as soon as possible to minimize silt - and sediment-laden runoff. The pH shall be kept within the range of 6.0 to 8.5 at the POD.

13. Percolation Pond Overflow

There shall be no discharge from the wastewater treatment system percolation pond except during emergency conditions caused by severe weather. Any discharge from the existing overflow pipe shall be reported to the Department and the Environmental Protection Agency. All discharges from this overflow system shall be monitored for pH, TSS, oil and grease, and the metals listed in condition II, B.1.; the flow and duration of flow shall be estimated.

B. Water Monitoring Programs

The permittee shall monitor and report to the Department the listed parameters on the basis specified herein. The methods and procedures utilized shall receive written approval by the Department. The monitoring program may be reviewed annually by the Department, and a determination may be made as to the necessity and extent of continuation, and may be modified in accordance with Condition No. XXV.

1. Chemical Monitoring

The following parameters shall be monitored during discharge as shown, discharge commencing with the start of commercial operation of Unit 4 and reported quarterly to the Departments Southwest District Office:

Parameter	Location	Sample Type	Frequency
Flow, Cooling	Intake	Pump Log	Continuous
Flow, Bottom Ash	Prior to CWS	Recorder	Continuous
Flow, Boiler Blowdown	Prior to CWS	Daily Log	Daily
Flow, FGD Bleed	Prior to CWS	Recorder	Continuous
pH	CWS and prior to CWS on FGD Bleed	Multiple Grabs	Weekly
	Boiler & Bottom Ash Blowdown	Grab "	Two per Week
Temperature	CWS Outfall	Recorder	Continuous
TSS	Bottom Ash Blowdown, FGD Bleed	Grab	Two per Week
Chlorine, Total Residual	Outfall	Multiple Grab	Weekly
Oil and Grease	Boiler Blowdown Bottom Ash Blowdown and FGD bleed	Grab	Two per Month
Metals	Intake, Outfall FGD Bleed Stream Bottom Ash Blow- Prior to discharge to CWS	Two-Grab composite, not less than three hours between samples	Two per Month for the first year, then monthly thereafter
Arsenic	"		"
Cadmium	"		"
Iron	"		"
Lead	"		"
Mercury	"		"
Selenium	"		"
Zinc	"		"
Copper	"		"
Chromium	"		"
Nickel	"		"

2. Biological Monitoring

a. Thermal Studies

Sampling shall be done on a bi-monthly basis commencing one month after certification and shall continue for a period of one year after Unit 4 is on-line. Such sampling shall consist of a baseline survey and an intensive survey. Sampling methodology shall be the same as that in the 1979 aquatic biology studies. Deviations from that methodology shall be approved by the DER.

All raw data shall be available upon request by DER. At the end of the first year of post-operational study, the Department shall review all of the data in the form of an annual report and shall determine if

*CWS - Cooling Water System

Revised 6/2/81

mitigative action must be taken by TECO and shall determine if the impacts of the thermal discharge are in compliance with the requirements of Section 17-3. 05(1)(f) and if the thermal mixing zone granted by Condition II.A.3 is appropriate. If the data are sufficient to convince the Department that severe thermal effects have been confined to an acceptably limited area, the monitoring studies shall be terminated. If not, the studies shall be continued until such time as the thermal impact can be thoroughly evaluated.

(1) Baseline Survey

In order to put the 1979 benthic study in proper ecological perspective regarding the regular cyclical biotic fluctuations which are known to occur in Tampa Bay, the following program shall be implemented:

i. Benthic macroinvertebrate sampling shall be carried out on a bi-monthly basis one month after the time of enactment of certification until a period of 12 months prior to commencement of operation of Unit 4. Five stations corresponding to stations 5, 6, 8, 11, and 12 of the 1979 Benthic Ecology Study* shall be sampled according to the methods outlined in the TECo benthic report. Deviations from that methodology shall be approved by the DER.

ii. Water quality parameters shall be monitored during the benthic sampling program on a bi-monthly basis at each of the above stations. Parameters to be examined shall include salinity, dissolved oxygen, turbidity, and water temperature (top and bottom).

iii. A sediment analysis shall be carried out at each of these stations on a bi-monthly basis corresponding to the benthic sampling according to the methods outlined in the 1979 Benthic Study. If sediment samples show little bimonthly variability, TECo may request a less rigorous sampling frequency.

(2) Intensive Survey

In order to adequately assess the thermal impact of Big Bend Unit 4 in conjunction with the combined plume discharge from Units 1, 2, and 3, the following biological monitoring program shall be implemented one year before and shall continue for one year after commencement of operation of Unit 4. A proposal for these intensive studies shall be prepared by the applicant and shall be submitted to DER for approval at least 18 months prior to commercial operation of Unit 4. Such a proposal shall reflect the methodologies employed during the 1979 study so that both data sets can be compared for evaluation of thermal impact from Unit 4.

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*"A Study of Thermal Effects on Benthic Communities of Big Bend, Tampa Bay (Florida)", July 1980. TECO

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i. The applicant shall collect bi-monthly benthic, samples. The stations to be chosen for the Benthic sampling program shall be taken from the 1979 Benthic Ecology Study plus three additional stations. These three stations shall be located on a transect running into the bay from station 8, paralleling stations 5, 6, and 7 of the 1979 study. Water quality parameters and sediment samples shall be collected and analyzed as in the baseline survey.

ii. Stations 1 and 2 shall be deleted from the proposed studies.

iii. Trammel (or gill net) and trawl samples shall be taken each month during the day and at night in the vicinity of the embayment--Apollo Beach pass. If possible, night sampling shall be during a flood tide. Additionally, monthly seine samples shall be collected in the area during the day.

Entrainment

1. In order to evaluate the entrainment mortality at the Big Bend Station, TECO shall conduct a Fine Mesh Screen Survivability Study (similar to the 1980 Prototype FMS study) for one full spawning period (March through September). Sampling for the study will be conducted at three locations pertaining to Unit 4:

Station 1:	Front of screen after organisms are impinged and washed to the screen return system.
Station 2:	Behind the screen.
Station 3:	At the discharge point in the Organism Return Canal(ORC).

Stations 1 and 2 will be sampled simultaneously to estimate the total number of organisms entrained at the plant. Initial and latent mortality tests will be conducted on organisms collected at stations 1 and 3 only. A detailed scope of study shall be submitted by TECO at least twelve months prior to the commencement of commerical operation of Unit 4.

III. Water Use

A. Use of Water

TECO shall use the lowest quality water which it has the ability to use. To the extent that a dependable supply of non-potable water can be provided, TECO shall use the non-potable water in lieu of the potable water from the public water supply system of Hillsborough County. However, if TECO can demonstrate that non-potable water is not available due to technical or environmental reasons, then the use of potable water may be authorized by the Secretary upon the concurrence of the Southwest Florida Water Management District (SWFWMD).

B. Consumptive Use of Groundwater

1. In the event that fresh groundwater in excess of quantities permitted by SWFWMD should be required for the operation of Big Bend Unit 4, TECO shall demonstrate to the satisfaction of the SWFWMD that such a consumptive use of groundwater will be in compliance with the regulations and policies of the District and will have no significant adverse effect on regional water supplies.

2. In the event that use of brackish groundwater should become necessary, an intensive investigation and aquifer testing program shall be performed by TECO. The aquifer

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testing program shall be submitted to the Department and the Director, Regulatory Division of SWFWMD, and approved prior to commencement of the investigation. The investigation should include but need not be limited to the following:

a. The geology encountered while drilling the well, with emphasis placed on the depth, thickness and hydraulic characteristics of formations encountered.

b. The aquifer systems that are encountered, along with the discussion on water quality and availability.

c. Performance of a pump test, description of aquifer characteristics and evaluation procedure.

d. Interpretations of geophysical logs.

e. Discussion of aquifer recharge and ultimate source.

Upon completion of the investigations, TECO shall submit a report on the feasibility of utilizing brackish groundwater for cooling tower make-up, and at that time the SWFWMD may authorize withdrawals. If SWFWMD should authorize withdrawals of brackish water, TECO shall submit monthly pumpage reports and chlorides, sulfate and TDS analysis on the production well to the SWFWMD.

C. Emergency Shortages

In the event an emergency water shortage should be declared pursuant to Section 373.175 or 373.246, F.S., by Southwest Florida Water Management District for an area including Hillsborough County, the Department pursuant to Section 403.516, F.S., may alter, modify, or declare to be inactive all or parts of Condition III.A.-E. An authorized SWFWMD representative at any reasonable time may enter the property to inspect the facilities.

D. Monitoring and Reporting

Tampa Electric Company shall implement the following groundwater monitoring program:

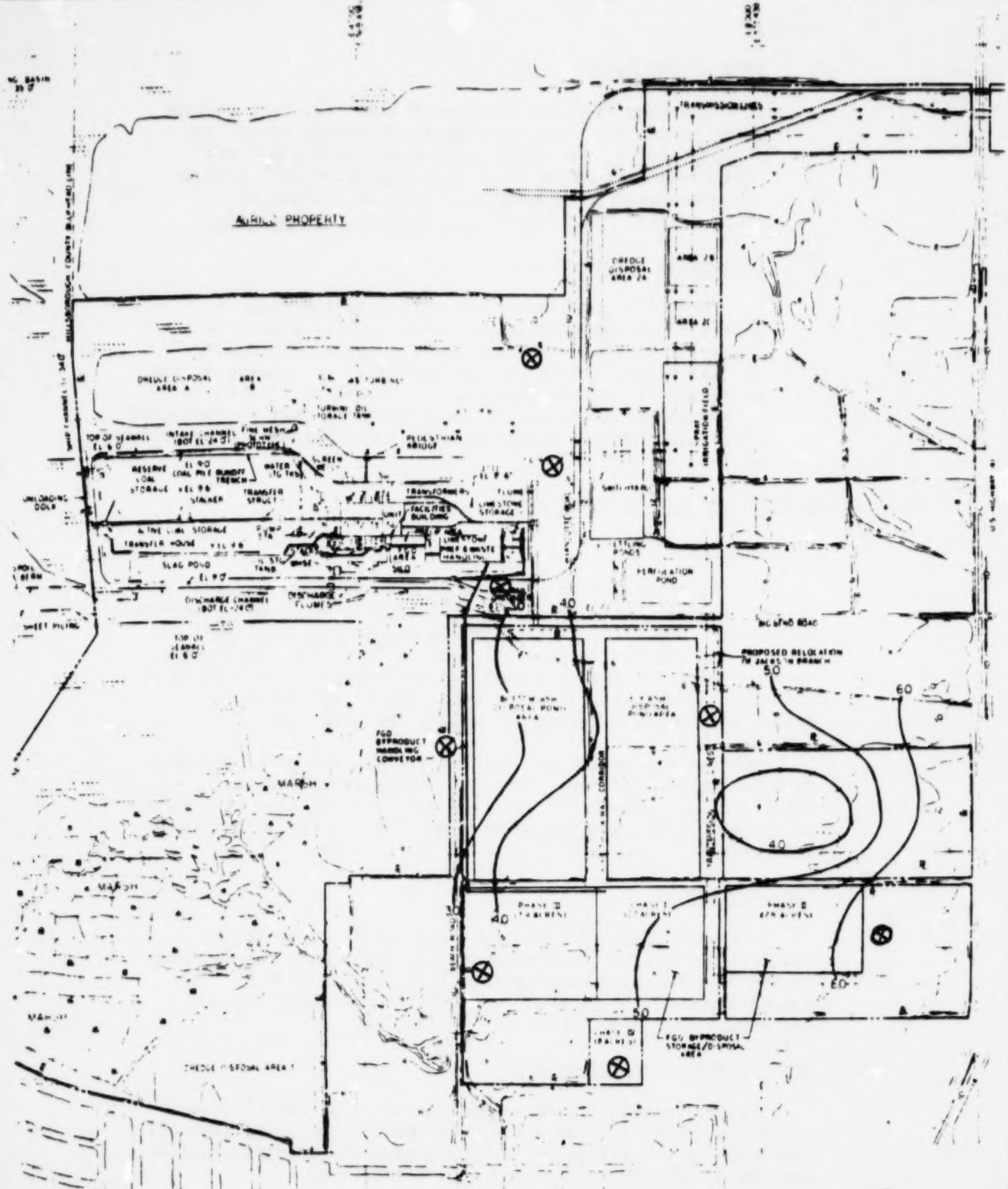
1. The groundwater levels shall be monitored at wells as approved by DER and the Southwest Water Management District. Chemical analyses shall be made on samples from all monitored wells identified in this Condition. The location, frequency, water levels and selected chemical analyses shall be as given in Condition III.D.3.

2. The groundwater monitoring program shall be implemented at least one year prior to operation of Big Bend Unit 4. The chemical analyses shall be in accord with the latest edition of Standard Methods for the Analysis of Water and Wastewater. The data shall be submitted within 30 days of collection/analysis to the Southwest Florida Water Management District and to the DER Power Plant Siting Section.

3. After consultation with the DER and SWFWMD, TECO shall install a monitoring well system, as generally shown on Figure 3, to monitor groundwater quality in the top 40 feet of the surficial aquifer. One well shall be installed to a depth greater than 40 feet but less than 100 to monitor vertical dispersion or groundwater contaminants. Monitoring well locations and designs shall be submitted to the Department and SWFWMD for review. Approval or disapproval of the locations and design shall be granted within 60 days. The water samples collected from each of the monitor wells shall be collected immediately after removal by pumping of a quantity of water equal to two casing volumes. The water quality analyses shall be performed monthly during the year prior to commercial operation and for two years after operation and quarterly thereafter. Results shall be submitted to the Department and the SWFWMD by the fifteenth (15th) day of the month following the month during which such analyses were performed. Testing for the following constituents is required:

   Conductance
   pH
   Chloride
   Iron
   Cadmium
   Zinc
   Copper
   Sulfate
   Silver
   Nickel
   Selenium
   Chromium
   Arsenic
   Beryllium
   Mercury
   Lead
   Gross Alpha
   Barium

4. After the second year of monitoring and periodically thereafter, the Department and the permittee shall review the results of the monitoring program and determine the necessity for modifying or continuing the program.


AGRICO PROPERTY
DREDGE DISPOSAL AREA 2A
AREA 2B
AREA 2C
DREDGE DISPOSAL AREA A
TURBINE OIL STORAGE TANK
PEDESTRIAN BRIDGE
TOP OF SEAWALL EL 6.0'
INTAKE CHANNEL
RESERVE COAL STORAGE
COAL PILE RUNOFF TRENCH
UNLOADING DOCK
ACTIVE COAL STORAGE
TRANSFER HOUSE
STACKER
TRANSFER STRUCT
PUMP STA
TRANSFORMERS
FACILITIES BUILDING
LIMESTONE STORAGE
SLAG POND
SILO
DISCHARGE CHANNEL
DISCHARGE FLUMES
SHEET PILING
SWITCHYARD
SETTLING PONDS
PERCOLATION POND
SPRAY IRRIGATION FIELD
TRANSMISSION LINES
BIG BEND ROAD
PROPOSED RELOCATION OF JACKSON BRANCH
BOTTOM ASH DISPOSAL POND AREA
FLY ASH DISPOSAL POND AREA
CORRIDOR
FGD BYPRODUCT HANDLING CONVEYOR
MARSH
MARSH
MARSH
PHASE II
PHASE I
PHASE II
PHASE III
FGD BYPRODUCT STORAGE/DISPOSAL AREA
DREDGE DISPOSAL AREA
U.S. HIGHWAY 41
30
40
40
40
50
50
60
60

Monitoring Well--- ⊗

FIGURE 3

E. Leachate

1. Zone of Discharge

Leachate from the FGD/gypsum landfill, coal storage pile, bottom ash pond, wastewater treatment ponds, ash disposal cells, and spray irrigation field shall not contaminate waters of the State (including both surface and groundwaters) in excess of the limitations of Chapter 17-3, FAC., beyond the boundary of the site.

2. Corrective Action

When the groundwater monitoring system shows a violation of the groundwater water quality standards of Chapter 17-3, FAC., the appropriate ponds, FGD landfill, or coal pile shall be sealed, relocated or closed, or the operation of the affected facility shall be altered in such a manner as to assure the Department that no violation of the groundwater standards will occur beyond the boundary of the site.

IV. Control Measures During Construction

A. Stormwater Runoff

During construction, necessary measures shall be used to settle, filter, treat or absorb silt-containing or pollutant-laden stormwater runoff to limit the suspended solids to 50 mg/l or less at the POD during rainfall periods less than the 10-year, 24-hour rainfall, and to prevent an increase in turbidity of more than 50 Jackson Turbidity Units above background in waters of the State beyond 150 meters from the POD.

Control measures shall consist at the minimum of filters, sediment traps, barriers, berms or vegetative planting. Exposed or disturbed soil shall be protected as soon as possible to minimize silt- and sediment-laden runoff. The pH shall be kept within the range of 6.0 to 8.5 at the POD.

B. Sanitary Wastes

Disposal of sanitary wastes from construction toilet facilities shall be in accordance with applicable regulations of the Department and appropriate local health agency. The sewage treatment plant shall be operated in accordance with Chapters 17-3, 17-6, 17-16, and 17-19, FAC.

C. Environmental Control Program

An environmental control program shall be established under the supervision of a qualified person to assure that all construction activities conform to good environmental practices and the applicable conditions of certification.

The permittee shall notify the Department by telephone if unexpected harmful effects or evidence of irreversible environmental damage are detected during construction, shall immediately report in writing to the Department and shall within two weeks provide an analyses of the problem and a plan to eliminate or significantly reduce the harmful effects or damage and a plan to prevent reoccurrence.

D. Discharge of Construction Dewatering Effluent

Construction dewatering effluent shall be treated as appropriate to limit suspended solids to no more than 50 mg/l. The discharge of construction dewatering liquids shall not cause turbidity in excess of 50 Jackson Turbidity Units above ambient beyond a 20 meter radius from the point of discharge. Weekly grab samples will be collected and analyzed for suspended solids.

V. Solid Wastes

Solid wastes resulting from construction or operation shall be disposed of in accordance with the applicable regulations of Chapter 17-7, FAC. The permittee shall submit a program for approval outlining the methods to be used in handling and disposal of solid wastes. Such program shall indicate at the least methods for erosion control, covering, vegetation and quality control.

Open burning in connection with land clearing shall be in accordance with Chapter 17-5, FAC. No additional permits shall be required, but the Division of Forestry shall be notified prior to burning. Open burning shall not occur if the Division of Forestry has issued a ban on burning due to fire hazard conditions.

VI. Operation Safeguards

The overall design, layout, and operation of the facilities shall be such as to minimize hazards to humans and the environment. Security control measures shall be utilized to prevent exposure of the public to hazardous conditions. The Federal Occupational Safety and Health Standards will be complied with during construction and operation. The Safety Standards specified under Section 440.56, F.S., by the Industrial Safety Section of the Florida Department of Commerce will also be complied with.

VII. Screening

The permittee shall provide screening of the site through the use of aesthetically acceptable structures, vegetated earthen walls and/or existing or planted vegetation in accordance with Hillsborough County ordinances.

VIII. Potable Water Supply System

The potable water supply system shall be designed and operated in conformance with Chapter 17-22, FAC. Information as required in 17-22.108 shall be submitted to the Department prior to construction and operation. The operator of the potable water supply system shall be certified in accordance with Chapter 17-16, FAC.

IX. Transformer and Electric Switching Gear

The foundations for transformers, capacitors, and switching gear necessary to connect Big Bend Unit 4 to the existing distribution system shall be constructed of an impervious material and shall be constructed in such a manner as to allow complete collection and recovery of any spills or leakage of oily, toxic, or hazardous substances.

X. Toxic, Deleterious, or Hazardous Materials

The spill of any toxic, deleterious, or hazardous materials shall be reported in the manner specified by Condition XV.

XI. Construction in Waters of the State

A. Intake and Discharge

1. No construction on sovereignty submerged lands shall commence without obtaining lease or title from the Department of Natural Resources.

2. Construction of intake and discharge structures should be done in a manner to minimize turbidity. Turbidity screens should be used to prevent turbidity in excess of 50 JTUs above background beyond 150 meters from the dredging, pile driving, or construction site.

3. The construction methodology for the intake structure and screens shall be provided to the Department's Southwest District Office for review prior to construction.

4. All spoil shall be piped hydraulically or trucked to an upland disposal site of sufficient capacity to retain all material.

5. Effective stabilization of submerged bottom sediments at the Cooling Water System discharge should be achieved and maintained during the period of operation by the placement of concrete, riprap or other suitable material.

B. Relocation of Jackson Branch

1. An equivalent square footage of mangroves will be replanted in the new creek cut.

2. The new creek will have 6:1 side slopes from +1' MSL to -1' MSL.

3. *Juncus* sp. are to be planted at three foot intervals for the entire length of the relocated segment of the branch according to sound management practices.

4. The 90° turn in the creek should be stabilized by riprap as well as the planting of a higher concentration of *Juncus* sp. on the outside of the turn.

5. The relocated cut is to be excavated and stabilized behind an upstream plug before being connected to the existing creek; conversely, the existing branch shall not be taken off line until the new cut is stabilized and JTUs are less than 25 in the new channel.

6. Permittee should submit to the Southwest District Office a replanting proposal at least 60 days prior to commencement of construction, including species, methods and placement details.

7. Permittee will monitor the outfall of Jackson Branch twice daily during construction for turbidity in JTUs and report these results weekly to the Southwest District Office.

C. Newman Branch

1. In the construction of the FGD/gypsum disposal areas, TECO shall not alter the ditch along the east side of Beach Road, as that ditch is tidally connected to Newman Branch.

2. To mitigate against the loss of the grass pond in the area designated as Phase I of the FGD/gypsum disposal area, TECO shall reconstruct the northernmost east-west drainage canal. The side slopes of this drainage canal on the TECO property shall be reduced to at least 6:1 (horizontal to vertical) and planted with *Juncus effusus*. Such reconstruction shall be done in a manner to prevent violation of Section 17-3.121, F.A.C, Water Quality Criteria. Plans for canal reconstruction shall be submitted to the Department for approval sixty days prior to reconstruction of the canal.

XII. FGD/Gypsum Landfill

The proposed FGD/gypsum landfill area shall be monitored and studied pursuant to a detailed groundwater testing and monitoring program as defined in Condition III D.

The results of the program will be used by the Department in determining whether TECO has affirmatively demonstrated that Florida Water Quality Criteria (Chapter 17-3, F.A.C) will not be violated.

If the Department determines that TECo has failed to affirmatively demonstrate that Florida Water Quality Criteria (Chapter 17-3, F.A.C) will not be violated, TECo shall within 90 days of such determination present to the Department a plan of correction (which may include, if appropriate, an impermeable liner) for review and approval by the Department and for timely implementation by TECO.

Construction of perimeter berms shall be in conformance with the provisions of Chapter 17-9, FAC, regarding earthen dams.

XIII. Transmission Lines

Directly associated transmission lines shall be constructed and maintained in order to minimize environmental impacts in accordance with Chapter 403, F.S.

XIV. Change in Discharge

All discharges or emission authorized herein shall be consistent with the terms and conditions of this certification. The discharge of any pollutant not identified in the application or any discharge more frequent than, or at a level in excess of, that authorized herein shall constitute a violation of the certification. Any anticipated facility expansions, production increases, or process modification which will result in new, different or increased discharges or expansion in steam generating capacity will require a submission of a new or supplemental application pursuant to Chapter 403, Florida Statutes.

XV. Noncompliance Notification

If, for any reason, the permittee does not comply with or will be unable to comply with any limitation specified in this certification, the permittee shall notify the Manager of DER's Southwest District Office by telephone during the working day in which permittee becomes aware of said noncompliance and shall confirm this situation in writing within seventy-two (72) hours supplying the following information:

a. A description and cause of noncompliance; and

b. the period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying event.

XVI. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this certification. Such systems are not to be bypassed without prior Department approval. The one exception is that during periods when light oil is used for ignition, the FGD system may be bypassed.

XVII. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact resulting from noncompliance with any limitation specified in this certification, including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying event.

XVIII. Right of Entry

The permittee shall allow the Secretary of the Florida Department of Environmental Regulation and/or authorized respresentatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which records are required to be kept under the terms and conditions of this permit; and

b. to have access to and copy all records required to be kept under the conditions of this certification; and

c. to inspect and test any monitoring equipment or monitoring method required in this certification and to sample any discharge or pollutants; and

d. to assess any damage to the environment or violation of ambient standards.

XIX. Revocation or Suspension

This certification may be suspended or revoked pursuant to Section 403.512, Florida Statutes, or for violations of any Condition of Certification.

XX. Civil and Criminal Liability

This certification does not relieve the permittee from civil or criminal responsibility or liability for noncompliance with any conditions of this certification, applicable rules or regulations of the Department, or Chapter 403, Florida Statutes, or regulations thereunder.

Subject to Section 403.511, Florida Statutes, this certification shall not preclude the institution of any legal action or relieve the permittee from any responsibilities or penalties established pursuant to any other applicable State Statutes or regulations.

XXI. Property Rights

The issuance of this certification does not convey any property rights in either real or personal property, tangible or intangible, nor any exclusive privileges, nor does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations. The applicant will obtain title, lease or right of use to any sovereign submerged lands occupied by the plant, transmission line structures, or appurtenant facilities from the State of Florida.

XXII. Severability

The provisions of this certification are severable, and, if any provision of this certification or the application of any provision of this certification to any circumstances is held invalid, the application of such provision to other circumstances and the remainder of the certification shall not be affected thereby.

XXIII. Definitions

The meaning of terms used herein shall be governed by the definitions contained in Chapter 403, Florida Statutes, and any regulation adopted pursuant thereto. In the event of any dispute over the meaning of a term used in these general or special conditions which is not defined in such statutes or regulations, such dispute shall be resolved by reference to the most relevant definitions contained in any other state or federal statute or regulation or, in the alternative, by the use of the commonly accepted meaning as determined by the Department.

XXIV. Review of Site Certification

The certification shall be final unless revised, revoked or suspended pursuant to law. At least every five years from the date of issuance of this certification or any National Pollutant Discharge Elimination System Permit issued pursuant to the Federal Water Pollution Control Act Amendments of 1972 for the plant units, the Department shall review all monitoring data that has been submitted to it during the proceeding five-year period for the purpose of determining the extent of the permittee's compliance with the conditions of this certification of the environmental impact of this facility. The Department shall submit the results of its review and recommendations to the permittee. Such review will be repeated at least every five years thereafter.

XXV. Modification of Conditions

The conditions of this certification may be modified in the following manner:

A. The Board hereby delegates to the Secretary the authority to modify, after notice and opportunity for hearing, any conditions pertaining to consumptive use of water, monitoring, sampling, groundwater, mixing zones, zones of discharge or variances to water quality standards.

B. All other modifications shall be made in accordance with Section 403.516, Florida Statutes.

XXVI. Flood Control Protection

The plant and associated facilities shall be constructed in such a manner as to comply with the Hillsborough County flood protection requirements.

XXVII. Effect of Certification

Certification and conditions of certification are predicated upon design and performance criteria indicated in the application. Thus, conformance to those criteria, unless specifically amended, modified, or as the Department and parties are otherwise notified, is binding upon the applicant in the preparation, construction and maintenance of the certified project. In those instances where a conflict occurs between the application's design criteria and the conditions of certificaiton, the conditions shall prevail.

XXVIII. Fine Mesh Screens

Fine mesh screens, similar to those tested and described by TECO in the 316 Demonstration, shall be installed on the intakes of Units 3 and 4 with the appropriate sprays and screen wash sluice return system to minimize entrainment. The screen wash sluice return system shall discharge to the east end of the canal north of the intake canal or to a location acceptable to the Department and EPA. TECO shall submit a plan to DER to explore the possibility of re-entrainment of ORC--returned organism.

XXIX. Noise

To mitigate the effects of noise produced by the steam blowout of steam boiler tubes and by construction of the Phase IV FGD byproduct disposal area, TECo shall conduct public awareness campaigns prior to such activities to forewarn the public of the estimated time and duration of the noise.

XXX. Variances

TECO is granted variances for discharges of boiler blowdown, FGD system blowdown and bottom ash pond blowdown pursuant to Sections 403.201 and 403.511(2) F.S., for a period of two years after the start of commercial operation for the following parameters:

a. Arsenic - 17-3.061(2)(a)
b. Cadmium - 17-3.121(9)
c. Chromium - 17-3.061(2)(d)
d. Copper - 17-3.121(11)
e. Iron - 17-3.121(16)
f. Mercury - 17-3.121(18)
g. Nickel - 17-3.121(19)
h. Selenium - 17-3.121(26)

During the period that the variance is in effect, TECO shall (1) determine the concentrations of the above metals as well as lead in the three discharge streams; (2) operate the FGD blowdown treatment system so as to minimize the metal content of the discharge from the system; (3) explore the practicability of treating the boiler blowdown in the FGD treatment system when there is capacity in the system to accomodate that blowdown; and (4) submit reports of the above studies and analyses after the first year and at least twenty months after the start of commercial operation of Unit 4. Based upon data from existing Units 1, 2, and 3 contained in the application, during the period of the variance, the quality of the boiler blowdown shall not exceed the following:

Arsenic	0.2	mg/l
Cadmium	0.005	mg/l
Chromium	0.065	mg/l
Copper	0.04	mg/l
Iron	0.001	mg/l
Lead	0.05	mg/l
Mercury	0.007	mg/l
Nickel	0.096	mg/l
Selenium	0.032	mg/l

Upon receipt of the aforementioned reports, the Secretary shall determine whether the variances should be renewed and may impose appropriate conditions to minimize the discharges and their impacts.

Appendix G

FLORIDA PUBLIC SERVICE COMMISSION ORDER RELATIVE TO BIG BEND UNIT 4

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Application for certification of Tampa Electric Company's proposed 417 megawatt net coal-fired Big Bend Unit No. 4.	DOCKET NO. 800595-EU ORDER NO. 9749 ISSUED: 1-16-81

The following Commissioners participated in the disposition of this matter:

JOSEPH P. CRESSE
GERALD L. GUNTER
WILLIAM T. MAYO
JOHN R. MARKS, III

O R D E R

BY THE COMMISSION:

A formal hearing was conducted on December 18, 1980, pursuant to Tampa Electric Company's application for certification of a proposed 417 megawatt net coal-fired Big Bend Unit 4 power plant which invoked this Commission's jurisdiction pursuant to the Florida Power Plant Siting Act, Chapter 403, Florida Statutes. That Act requires the Commission to prepare a final report as to the present and future need for the proposed electrical power plant. As required by Section 403.507(1)(b), a preliminary report was filed with the Department of Environmental Regulation on October 17, 1980.

The preliminary Commission report highlighted pertinent aspects of those areas relevant to a "need" determination which required evidentiary substantiation. From a preliminary standpoint, Florida peninsular kilowatt hour capacity was observed to be sufficient without Big Bend Unit 4, in light of the anticipated attainment of Commission conservation goals. As concerning Tampa Electric's more limited service area, however, the preliminary observation was that Big Bend 4 or its equivalent generating capacity with an in-service date of March 1985 appeared to be needed. Premised upon Tampa Electric's coal and oil price projections, an economic need for Big Bend 4 was also indicated. Socio-economic benefits were gleaned from anticipated savings associated with the displacement of approximately 3.9 million barrels of oil annually by Big Bend 4's coal-fired generation. A final observation focused upon the consequences of non-certification or deferral of certification of Big Bend 4, as such action pertained to the adequacy of bulk power supply to Tampa Electric's customers.

A more thorough inquiry and analysis of the aforementioned pertinent issues was had at the December 18 hearing. The final evaluation of the issues presented encompassed a more in-depth consideration of additional capacity needs requisite to an adequate bulk electrical power and energy supply at the lowest possible cost; and the socio-economic need of reducing consumption of imported oil in the State of Florida.

At the hearing, Mr. H. L. Culbreath, President of Tampa Electric, expressed the basic considerations which influenced the company's decision to seek certification of Big Bend Unit 4. In his testimony, economic growth was given as the decisive factor. This growth has arisen principally because Florida is recognized as a "sunbelt" state naturally attracting increasing numbers of tourists and permanent residents. Also, cited were the Governor's efforts to expand the state's industrial base.

The resultant increase in industrial expansion, combined with historical population growth, has made Florida the eighth most populous state. It will be the fourth most populous state by 1990, if recent trends continue. Florida, now has three of the nation's five fastest growing retail sales markets and ranks second only to Virginia in the southern states in average income.

Tampa Electric's service area is reflective of this statewide economic growth picture. In Tampa's downtown area there is presently under construction four major office buildings, a 540-room Hyatt-Regency Hotel, and a 187 unit condominium project. Seddon Island will soon be developed into a major multi-use working and living environment. Max Factor III has planned construction of a similar multi-use project and there are plans for a like development in the Hyde Park area of Central Tampa.

Expected increase demand is also evident throughout Tampa Electric's service area. Deltona is planning "Tampa Palms" northeast of Tampa which is slated to have 13,497 living units and commercial developments as well. U.S. Home is planning a 2500 living unit development southeast of Brandon and a similar 6300 living unit development east of Big Bend station. Single-family housing permits in Hillsborough County are 13% higher than the same three month period a year ago.

The forecasted growth rate incorporates assumed achievement of the Commission's conservation goals of reductions in peak-load and energy usage. Projected Tampa Electric system capability is 2522 MW in the winter of 1985-86 without Big Bend Unit 4 and accounting for conservation, forecasted firm load will amount to 2225 MW. A reserve margin of only 13% would result with a high probability that the load could not be served when planned maintenance and forced outages are considered. With Big Bend Unit 4 on line January 1, 1986, total capacity available for firm load would be 2,731 megawatts, providing a reserve margin of approximately 23%. Postponement of Big Bend 4 would thus seriously jeopardize future service to customers.

Permeating every issue presented was the conservation goals established by Commission Order No. 9634 which is attached as Appendix A to the final report. Attainment of these goals would reduce the current projected level of Peninsular energy growth during the period of 1980 through 1989 from 4.3 percent to 2.6 percent (State of Florida, 1980 Ten Year Plan). The rate of Peninsular summer and winter firm peak load growth during this period would be reduced from 4.6 percent (summer and winter) to 2.5 percent (summer) and 2.0 percent (winter). The resultant drop in consumption of oil for electrical generation would amount to 25% of that projected in the State of Florida, 1980 Ten Year Plan, in 1990.

The conservation goals also impact upon the reserve margins for firm load. If the goals are achieved, Peninsular reserve margins will range from 31.5 percent for the 1980/81 winter peak to 56.5 percent for the 1988/89 winter peak. Elimination of current generation expansion plans of Peninsular Florida Utilities would result in reserve margins ranging from 31.5 percent in the winter of 1980/81 to 33.7 percent in the winter of 1988/89. Thus, achievement of the conservation goals would obviate the Peninsular system's need for Big Bend 4 from an adequacy viewpont. In the event the goals are not achieved, however, additional Peninsular generating capacity may be needed.

Unlike the scenario for Peninsular Florida, achievement of the Commission's preliminary kw conservation goals would have an inapposite effect upon Tampa Electric's generation capacity. Application of the conservation goals set for Tampa Electric discloses that the company's reserve margins would range from 26.5 percent during the winter of 1980/81 to 29.5 percent during the winter of 1988/89, assuming an in-service date of March 1985 for Big Bend 4. Such a margin would appear to be adequate, but, should construction of Big Bend 4 not be certified or significantly delayed, Tampa Electric's reserve margin would fall to 21.3 percent for the winter peak of 1985/86 and would continue to degrade to 11.7 percent for the winter of 1988.89. The need for additional Tampa Electric capacity in its own service area is therefore apparent.

One alternative to meet this additional capacity need would require Tampa Electric to enter contractual arrangements for firm power purchases from other Peninsular utilities at an economically competitive rate. Testimony elicited from Tampa Electric's G. Pierce Wood, Senior Vice-President, discloses such arrangements have been sought or studied with Florida Power Corporation, which has no available capacity from its certified units; Florida Power & Light, which has contracted for purchase of capacity and energy from Big Bend 4 during its first three years of operation; Lakeland and Gainesville; Tennessee Valley Authority; Seminole Electric Cooperative and out-of-state utilities. All such efforts have been determined not to be cost and or time effective on the basis of the economics considered. Continued efforts to obtain feasible contracts alleviating the necessity for additional construction of generation capacity are imperative, even though in this instance, an economically competive contract favorable to ratepayers could not be consummated.

Construction of Big Bend 4 is warranted as economically cost-effective based on the cost differential in coal and oil. Appendix D presents an analysis of Big Bend 4's effect on the capacity and generation mix of Peninsular Florida, revealing displacement of oil fired generation within the first nine months of operation should coal fired generation prove to be less expensive than oil fired. Supportive of the likelihood of these savings is the reasonableness of Tampa Electric's forecast of the rate of escalation associated with the prices for coal and oil. Tampa Electric's forecast assumes a 9% annual escalation rate for coal and a 14% rate for oil in 1985-1990, and 12% thereafter. The Commission staff's comparison of these rates with those forecasted by the Federal Energy Information Administration (EIA) disclosed they fall within ranges forecasted by EIA or are within an acceptable range relative to the average EIA escalation rate.

Tampa Electric estimated cumulative net savings of $1,763 million (1981) if Big Bend 4 is constructed. This estimate is based upon the aforementioned forecasted difference between coal and oil generation costs less the anticipated annual carrying costs of Big Bend 4, assuming no cost overruns. The estimated project cost for Big Bend 4 is $474 million which results in a benefit/cost ratio of approximately 3.7 to 1 based on Tampa Electric's projections. Pursuant to an independent Commission staff analysis, however, a worst case benefit/cost ratio of approximately 2.0 was derived.

The Staff's worst case analysis considered an estimate of construction cost overruns and other parameters and concluded that significant economic benefits will accrue from the construction of Big Bend 4. One focus of the analysis pertained to computation of non-firm interchange with other Peninsular Florida utilities, such as take place hourly through the Florida Electric Power Coordinating Group's (FCG) Power Broker and was found to be a quantified benefit. Total additional economy energy available for sale from Tampa Electric during the 1985 through 1990 period would approximate 4758 gigawatt hours. Priced at Tampa Electric's forecasted differential between coal and oil prices, the total peninsular savings due to the sale of this additional economy energy would approximate $130.5 million in present value 1980 dollars. Additional benefits resulting from subsequent economy interchange that will indirectly occur between other utilities pursuant to the energy broker were considered but not computed. Further savings were determined to range from $220 million (1980 dollars) to zero or negative dependent upon the level of construction cost overruns. However, the fact that the company has completed contracts for 90% of the construction of Big Bend 4 indicates that overruns should not be as great as the higher range of the analysis.

Should coal fired generation prove less costly than oil fired generation, as has been indicated by testimony in this case, substantial socio-economic benefits will be realized. An approximate savings of 3.9 million barrels of oil will be displaced annually by Big Bend 4 based upon Tampa Electric estimates contained in Appendix F of the final report. The impact of this reduction in Peninsular Florida's dependence on imported oil and correspondingly added security of fuel supplies is considerable. Assuming that the risk of loss due to unpredictable oil supplies is that in any year there is a 10 percent chance that only 50 percent of the oil required as fuel in steam plants is available, the value of Big Bend 4's contribution to reducing Florida's dependence on imported oil would approximate $232 million in 1980 dollars.

Although such matters as just how much additional generation capacity is cost-effective given the differential in coal and oil prices; economical alternatives to coal; a regional grid type system; coal by wire during non-peak hours and a detailed look at generating fuels expected to be utilized in Florida in 1985 through 1989, were not presented in-depth, future "need" certifications should and will be expected to more throughly encompass such areas of concern.

The cost-beneficial economics of constructing Big Bend 4 have been completely and substantially demonstrated by Tampa Electric Company in this proceeding and the "need" for the said power generation should be certified. It is therefore,

ORDERED by the Florida Public Service Commission that the attached final report of the Florida Public Service Commission on the need for Big Bend Unit No. 4 be and the same is hereby approved and adopted. It is further

ORDERED that the attached report be and the same is hereby incorporated herein by reference. It is further

ORDERED that the final report be submitted to the Department of Environmental Regulation.

By Order of the Florida Public Service Commission, this 16th day of January 1981.

(S E A L)

AS

STEVE TRIBBLE
COMMISSION CLERK

By: Carolyn S. Cheller
Deputy Clerk

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Application for certification of Tampa Electric Company's proposed 417 megawatt net coal-fired Big Bend Unit No. 4.	DOCKET NO. 800595-EU ORDER NO. 9749 ISSUED: 1-16-81

The following Commissioners participated in the disposition of this matter:

JOSEPH P. CRESSE
GERALD L. GUNTER
WILLIAM T. MAYO
JOHN R. MARKS, III

ORDER

BY THE COMMISSION:

A formal hearing was conducted on December 18, 1980, pursuant to Tampa Electric Company's application for certification of a proposed 417 megawatt net coal-fired Big Bend Unit 4 power plant which invoked this Commission's jurisdiction pursuant to the Florida Power Plant Siting Act, Chapter 403, Florida Statutes. That Act requires the Commission to prepare a final report as to the present and future need for the proposed electrical power plant. As required by Section 403.507(1)(b), a preliminary report was filed with the Department of Environmental Regulation on October 17, 1980.

The preliminary Commission report highlighted pertinent aspects of those areas relevant to a "need" determination which required evidentiary substantiation. From a preliminary standpoint, Florida peninsular kilowatt hour capacity was observed to be sufficient without Big Bend Unit 4, in light of the anticipated attainment of Commission conservation goals. As concerning Tampa Electric's more limited service area, however, the preliminary observation was that Big Bend 4 or its equivalent generating capacity with an in-service date of March 1985 appeared to be needed. Premised upon Tampa Electric's coal and oil price projections, an economic need for Big Bend 4 was also indicated. Socio-economic benefits were gleaned from anticipated savings associated with the displacement of approximately 3.9 million barrels of oil annually by Big Bend 4's coal-fired generation. A final observation focused upon the consequences of non-certification or deferral of certification of Big Bend 4, as such action pertained to the adequacy of bulk power supply to Tampa Electric's customers.

A more thorough inquiry and analysis of the aforementioned pertinent issues was had at the December 18 hearing. The final evaluation of the issues presented encompassed a more in-depth consideration of additional capacity needs requisite to an adequate bulk electrical power and energy supply at the lowest possible cost; and the socio-economic need of reducing consumption of imported oil in the State of Florida.

At the hearing, Mr. H. L. Culbreath, President of Tampa Electric, expressed the basic considerations which influenced the company's decision to seek certification of Big Bend Unit 4. In his testimony, economic growth was given as the decisive factor. This growth has arisen principally because Florida is recognized as a "sunbelt" state naturally attracting increasing numbers of tourists and permanent residents. Also, cited were the Governor's efforts to expand the state's industrial base.

The resultant increase in industrial expansion, combined with historical population growth, has made Florida the eighth most populous state. It will be the fourth most populous state by 1990, if recent trends continue. Florida, now has three of the nation's five fastest growing retail sales markets and ranks second only to Virginia in the southern states in average income.

Tampa Electric's service area is reflective of this statewide economic growth picture. In Tampa's downtown area there is presently under construction four major office buildings, a 540-room Hyatt-Regency Hotel, and a 187 unit condominium project. Seddon Island will soon be developed into a major multi-use working and living environment. Max Factor III has planned construction of a similar multi-use project and there are plans for a like development in the Hyde Park area of Central Tampa.

Expected increase demand is also evident throughout Tampa Electric's service area. Deltona is planning "Tampa Palms" northeast of Tampa which is slated to have 13,497 living units and commercial developments as well. U.S. Home is planning a 2500 living unit development southeast of Brandon and a similar 6300 living unit development east of Big Bend station. Single-family housing permits in Hillsborough County are 13% higher than the same three month period a year ago.

The forecasted growth rate incorporates assumed achievement of the Commission's conservation goals of reductions in peak-load and energy usage. Projected Tampa Electric system capability is 2522 MW in the winter of 1985-86 without Big Bend Unit 4 and accounting for conservation, forecasted firm load will amount to 2225 MW. A reserve margin of only 13% would result with a high probability that the load could not be served when planned maintenance and forced outages are considered. With Big Bend Unit 4 on line January 1, 1986, total capacity available for firm load would be 2,731 megawatts, providing a reserve margin of approximately 23%. Postponement of Big Bend 4 would thus seriously jeopardize future service to customers.

Permeating every issue presented was the conservation goals established by Commission Order No. 9634 which is attached as Appendix A to the final report. Attainment of these goals would reduce the current projected level of Peninsular energy growth during the period of 1980 through 1989 from 4.3 percent to 2.6 percent (State of Florida, 1980 Ten Year Plan). The rate of Peninsular summer and winter firm peak load growth during this period would be reduced from 4.6 percent (summer and winter) to 2.5 percent (summer) and 2.0 percent (winter). The resultant drop in consumption of oil for electrical generation would amount to 25% of that projected in the State of Florida, 1980 Ten Year Plan, in 1990.

The conservation goals also impact upon the reserve margins for firm load. If the goals are achieved, Peninsular reserve margins will range from 31.5 percent for the 1980/81 winter peak to 56.5 percent for the 1988/89 winter peak. Elimination of current generation expansion plans of Peninsular Florida Utilities would result in reserve margins ranging from 31.5 percent in the winter of 1980/81 to 33.7 percent in the winter of 1988/89. Thus, achievement of the conservation goals would obviate the Peninsular system's need for Big Bend 4 from an adequacy viewpont. In the event the goals are not achieved, however, additional Peninsular generating capacity may be needed.

Unlike the scenario for Peninsular Florida, achievement of the Commission's preliminary kw conservation goals would have an inapposite effect upon Tampa Electric's generation capacity. Application of the conservation goals set for Tampa Electric discloses that the company's reserve margins would range from 26.5 percent during the winter of 1980/81 to 29.5 percent during the winter of 1988/89, assuming an in-service date of March 1985 for Big Bend 4. Such a margin would appear to be adequate, but, should construction of Big Bend 4 not be certified or significantly delayed, Tampa Electric's reserve margin would fall to 21.3 percent for the winter peak of 1985/86 and would continue to degrade to 11.7 percent for the winter of 1988.89. The need for additional Tampa Electric capacity in its own service area is therefore apparent.

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The Staff's worst case analysis considered an estimate of construction cost overruns and other parameters and concluded that significant economic benefits will accrue from the construction of Big Bend 4. One focus of the analysis pertained to computation of non-firm interchange with other Peninsular Florida utilities, such as take place hourly through the Florida Electric Power Coordinating Group's (FCG) Power Broker and was found to be a quantified benefit. Total additional economy energy available for sale from Tampa Electric during the 1985 through 1990 period would approximate 4758 gigawatt hours. Priced at Tampa Electric's forecasted differential between coal and oil prices, the total peninsular savings due to the sale of this additional economy energy would approximate $130.5 million in present value 1980 dollars. Additional benefits resulting from subsequent economy interchange that will indirectly occur between other utilities pursuant to the energy broker were considered but not computed. Further savings were determined to range from $220 million (1980 dollars) to zero or negative dependent upon the level of construction cost overruns. However, the fact that the company has completed contracts for 90% of the construction of Big Bend 4 indicates that overruns should not be as great as the higher range of the analysis.

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By Order of the Florida Public Service Commission, this 16th day of January 1981.

(S E A L)

AS

STEVE TRIBBLE
COMMISSION CLERK

G-8 By: [illegible]
Deputy Clerk

Appendix H

FISH AND WILDLIFE SERVICE SECTION 7 LETTER OF CONSULTATION

United States Department of the Interior
FISH AND WILDLIFE SERVICE
15 NORTH LAURA STREET
JACKSONVILLE, FLORIDA 32202

April 28, 1981

Mr. Robert B. Howard, Chief
EIS Preparation Section
U.S. Environmental Protection Agency
345 Courtland Street
Atlanta, Georgia 30365

Re: Log No. 4-1-81-012

Dear Mr. Howard:

This responds to your letter of March 6 requesting formal consultation, pursuant to Section 7 of the Endangered Species Act for Tampa Electric Company's (TECO) Big Bend Unit No. 4. The Biological Assessment prepared for this project analyzed potential impacts for the following threatened and endangered species.

West Indian manatee - Endangered
Bald eagle - Endangered
Red-cockaded woodpecker - Endangered
Brown pelican - Endangered
Eastern indigo snake - Threatened
American alligator - Threatened

After reviewing the information provided and an on-site inspection on April 22, it is our Biological Opinion that the proposed operation of Unit No. 4 is not likely to jeopardize the continued existence of the West Indian manatee. In addition, we concur with your determination that the proposed project should not adversely impact the bald eagle, red-cockaded woodpecker, brown pelican, eastern indigo snake or American alligator.

There are several comments we would like to make at this time regarding the proposed project. In the report "Studies of the West Indian Manatee in Tampa Bay" by G. Patton, he concluded that the Big Bend Power Station ranked second in importance as a warm-water refuge. The first being the Gardinier Phosphate Plant located on the Alafia River. It was also determined that the eastern end of the discharge canal appeared to be the area of highest manatee use. This is also the area which an unimproved boat launching facility is located. Manatees have not been observed in the actual boat ramp region; however, boats must travel through the concentration area in order to move into the Gulf. During the on-site inspection, we noticed that manatee warning signs were posted at the boat ramp. We were also informed that the warm-water discharge of Unit No. 4 will be just west of the ramp. This additional warm water may influence the distribution of manatees in and around the boat ramp during the colder months.

In order to alleviate possible adverse impacts to manatees in the discharge canal, we suggest that TECO close the boat ramp between November 15 and March 30, when manatees are most likely to use the discharge canal as a warm-water refuge. It is our understanding that this property belongs to TECO.

Our second recommendation is that "Slow Boat Speed" signs be posted in the discharge canal. In fact, the discharge canal should be included in the winter sanctuaries that have been established throughout the state under the Florida Sanctuary Act of 1978. Patton observed on numerous occasions boats traveling at high speeds in the canal, thereby greatly increasing the potential of a manatee injury or death. The Fish and Wildlife Service will be most willing to work with TECO in contacting the proper state authorities to implement these recommendations. We are aware that the data shows that no dead or injured manatees have been reported in the discharge canal, but we strongly believe that precautions should be taken before an unfortunate incident occurs. The area has been identified as an important warm-water refuge in Tampa Bay; therefore, we do not look upon these recommendations as over-reaction.

An administrative record of this consultation is on file in this office.

This completes consultation under Section 7 of the Endangered Species Act. If there are any modifications made in the project or if additional information becomes available relating to threatened or endangered species, reinitiation of consultation may be necessary. This Biological Opinion is intended to assist EPA in meeting its responsibilities under Section 7. We firmly believe that our recommendations should be taken under consideration and we would appreciate in being kept informed as to the implementation.

Sincerely yours,

David W. Peterson

David W. Peterson
Acting Area Manager

Appendix I

CULTURAL RESOURCES ASSESSMENT LETTER, FLORIDA SECRETARY OF STATE

FLORIDA DEPARTMENT OF STATE
George Firestone
Secretary of State

[redacted]

DIVISION OF ARCHIVES, HISTORY
AND RECORDS MANAGEMENT
L. Ross Morrell, Director
(904) 488-1480

May 15, 1981

In reply refer to:

Mr. Louis Tesar
Historic Sites Specialist
(904) 487-2333

Mr. Robert B. Howard
Chief, EIS Preparation Section
U. S. Environmental Protection Agency
Region IV
345 Courtland Street
Atlanta, Georgia 30365

Re: Cultural Resource Assessment Request
Tampa Electric Company (TECO)
Big Bend Unit 4, Hillsborough County, Florida

Dear Mr. Howard:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Procedures for the Protection of Historic and Cultural Properties"), we have reviewed the above referenced project for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authorities for these procedures are the National Historic Preservation Act of 1966 (Public Law 89-665) as amended by P.L. 91-243, P.L. 93-54, P.L. 94-422, P.L. 94-458, and P.L. 96-515 and Presidential Executive Order 11593 ("Protection and Enhancement of the Cultural Environment").

A review of the Florida Master Site File indicates that no archaeological and historical sites are recorded for the project area. Furthermore, because of the location of the project, it is considered highly unlikely that any significant, unrecorded sites exist in the vicinity. Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing, in the National Register of Historic Places, or otherwise of national, state or local significance.

FLORIDA-State of the Arts
The Capitol • Tallahassee, Florida 32301 • (904) 488-3680

Mr. Robert B. Howard
May 15, 1981
Page Two

On behalf of the Secretary of State, George Firestone, and the staff of the Bureau of Historic Sites and Properties, I would like to thank you for your interest and cooperation in the protection of Florida's irreplaceable historic resources.

Sincerely,

George W. Percy

George W. Percy
Deputy State Historic
Preservation Officer

GWP:Teh

Appendix J

U.S. ENVIRONMENTAL PROTECTION AGENCY STANDARDS OF PERFORMANCE FOR NEW SOURCES

U.S. Environmental Protection Agency standards of performance for new sources: maximum allowable discharge concentrations by waste source (milligrams per liter)[a] (Sheet 1 of 2)

Waste source	Effluent Characteristics														
	Total suspended solids		Oil & grease		Allow. pH range[e]	PCB	Copper, total		Iron, total		Free available chlorine[b]		Zinc, chromium, phosphorus, and other corrosion inhibitors		Heat
	Daily max.[c]	Daily avg.[d]	Daily max.	Daily avg.			Daily max.	Daily avg.	Daily max.	Daily avg.	Max. instantaneous	Chlorination period avg.	Daily max.	Daily avg.	
All discharges[f]					6.0-9.0	ND									
Low-volume wastes[f,g]	100	30	20	15											
Bottom-ash-transport water[f,h]	100	30	20	15											
Fly-ash-transport water[f,i]	ND[j]	ND[j]	ND[j]	ND[j]											
Metal-cleaning wastes and boiler blowdown[f,g]	100	30	20	15			1	1	1	1					
Cooling-tower blowdown[f,k]											0.5	0.2	NDA[l]	NDA[l]	
Main condenser															ND[j,m]
Coal-pile runoff[n]		50[o]			6.0-9.0										
Construction runoff[n]		50[j,o]			6.0-9.0										

Abbreviations:
PCB = polychlorinated biphenyl compounds.
ND = no discharge.
NDA = no detectable amount.

Note: See footnotes at end of table.

U.S. Environmental Protection Agency standards of performance for new sources: maximum allowable discharge concentrations by waste source (milligrams per liter)[a] (Sheet 2 of 2)

[a] From Federal Register, Volume 39, No. 196, October 8, 1974 (Code of Federal Regulations, Title 40, Part 423 (Promulgated)) and Federal Register, Volume 45, No. 200, October 14, 1980 (Code of Federal Regulations, Title 40, Part 423 (Proposed)).

[b] Neither free available chlorine nor total residual chlorine may be discharged from any unit for more than 2 hours in any one day, and not more than one unit in any plant may discharge free available or total residual chlorine at any one time unless the utility can demonstrate to the Regional Administrator that the units in a particular location cannot operate at or below this level of chlorination. (Note: The instantaneous maximum concentration of 0.14 milligram per liter of total residual chlorine (total residual oxidants) is included in the October 14, 1980, proposal.)

[c] Maximum 24-hour value.

[d] Average value for 30 consecutive days.

[e] Measured in standard units.

[f] The quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow from the waste source by the concentration in the table.

[g] Include, but are not limited to, wastewaters from wet-scrubber air-pollution-control systems, ion-exchange water-treatment systems, water-treatment-evaporator blowdown, laboratory and sampling streams, floor drainage, cooling-tower-basin-cleaning wastes, and blowdown from house-service recirculating-water systems. Boiler blowdown is included in the October 14, 1980, proposal.

[h] The quantity of pollutants discharged shall not exceed the quantity determined by multiplying the flow of bottom-ash-transport water by the above concentrations and dividing the product by 20. The elimination of this requirement is included in the October 14, 1980, proposal.

[i] The dry-fly-ash-handling requirement (i.e., no discharge of copper, nickel, zinc, arsenic, and selenium) is included in the October 14, 1980, proposal .

[j] Limitations remanded and set aside by the United States Court of Appeals for the Fourth Circuit on July 16, 1976.

[k] Blowdown shall mean the minimum discharge of recirculating cooling water for the purpose of discharging materials contained in the process, the further buildup of which would cause concentrations exceeding limits established by the best engineering practice.

[l] No discharge of cooling-tower-maintenance chemicals that contain the 129 priority pollutants is included in the October 14, 1980, proposal.

[m] There shall be no discharge of heat from the main condensers except for heat that may be discharged in blowdown from cooling-water-recirculation systems, provided that the temperature at which the blowdown is discharged does not exceed at any time the lowest temperature of recirculated cooling water before the addition of the makeup water.

[n] Any untreated overflow from facilities constructed and operated to treat the volume of material-storage runoff and construction runoff that results from a 10-year, 24-hour rainfall event shall not be subject to the pH and total-suspended-solids limitations stipulated for this waste source.

[o] Instantaneous maximum limits, not daily averages.

Note: In the event that waste streams from various sources are combined for treatment or discharge, the quantity of each pollutant or pollutant property attributable to each controlled waste source shall not exceed the specified limitation for that waste source.

Appendix K

STATE OF FLORIDA WATER QUALITY STANDARDS

FLORIDA WATER QUALITY STANDARDS

Florida Rules of the Department of Environmental Regulation, Chapter 17-3 — Water Quality Standards; Adopted October 28, 1970; Amended March 4, 1971; June 10, 1972; August 30, 1972; June 3, 1973; February 12, 1975; August 26, 1975; June 10, 1976; July 13, 1978; October 28, 1978; January 1, 1979; Approved by U.S. Environmental Protection Agency March 1, 1979)

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Part I — Declaration and Intent
Part II — Definitions
Part III — Water Quality Criteria

PART I. DECLARATION AND INTENT

17-3.011 FINDINGS, DECLARATION AND INTENT

(1) Article II, Section 7 of the Florida Constitution requires abatement of water pollution, and conservation and protection of Florida's natural resources and scenic beauty.

(2) Section 403.021, Florida Statutes, declares that the public policy of the state is to conserve the waters of the state and to protect, maintain, and improve the quality thereof for public water supplies, for the propagation of wildlife, fish and other aquatic life, and for domestic, agricultural, industrial, recreational, and other beneficial uses. It also prohibits the discharge of wastes into Florida waters without treatment necessary to protect those beneficial uses of the waters.

(3) Congress, in Section 101(a)(2) of the Federal Water Pollution Control Act, as amended, declares that achievement by July 1, 1983, of water quality sufficient for the protection and propagation of fish, shellfish, and wildlife, as well as for recreation in and on the water, is an interim goal to be sought wherever attainable. Congress further states, in Section 101(a)(3), that it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited.

(4) The present and future most beneficial uses of all waters of the State have been designated by the Department by means of the classification system set forth in this Chapter pursuant to 403.061(12), F.S. Water quality standards are established by the Department to protect these designated uses.

(5) Pollution which causes or contributes to new violations of water quality standards or to continuation of existing violations is harmful to the waters of this state and shall not be allowed.

(6) The quality of water which exceeds the minimum quality necessary to support the designated use of those waters shall be protected and enhanced.

(7) The quality of waters which is lower than that necessary to support the designated use of those waters shall be protected and enhanced provided, however, the Department shall not strive to abate natural conditions.

(8) The highest protection shall be afforded to Outstanding Florida Waters.

(9) Because activities outside the State sometimes cause pollution of Florida's waters, the Department will make every reasonable effort to have such pollution abated.

(10) Water quality standards apply equally to and shall be uniformly enforced in both the public and private sector.

(11) The Department finds that excessive nutrients (total nitrogen and total phosphorus) constitute one of the most severe water quality problems facing the state. It shall be the Department policy to limit the introduction of man-induced nutrients into waters of the State. Particular consideration shall be given to the protection from further nutrient enrichment of waters which are presently high in nutrient concentrations and sensitive to further nutrient loadings. Also, particular consideration shall be given to the protection from nutrient enrichment of those waters presently containing very low nutrient concentrations less than 0.3 milligrams per litre (mg/l) total nitrogen or less than 0.04 milligrams per litre (mg/l) total phosphorus.

(12) Public interest shall not be construed to mean only those activities conducted solely to provide facilities or benefits to the general public. Private activities conducted for private purposes may also be in the public interest.

(13) The Commission, recognizing the complexity of water quality management and the necessity to temper regulatory actions with the realities of technological progress and the social and economic wellbeing of peoples, urges, however, that there be no compromise where pollutional discharges constitute a valid hazard to human health.

(14) The Commission requests that the Secretary seek and use the best environmental information available when making decisions on the effects of chronically and acutely toxic substances and carcinogenic, mutagenic, and teratogenic substances. Additionally, the Secretary is requested to seek and encourage innovative research and developments in waste treatment alternatives that might better preserve environmental quality and/or at the same time reduce the energy and dollar costs of operation.

(15) The present and future most beneficial uses of groundwaters of the State shall be protected to insure the availability and utility of this invaluable resource. To achieve such protection, the groundwaters of the State are classified for the first time and appropriate specific water quality criteria for those classes are set forth in this Chapter.

(16) The criteria set forth in this Chapter are minimum levels which are necessary to protect the designated uses of a water body. It is the intent of this Commission that permit applicants should not be penalized due to a low detection limit associated with any specific criteria.

(17) In adoption of the Outstanding Florida Waters designated on July 13, 1978, the Commission has been assured by the Secretary that adequate public notice has been given that these waters were being considered for this designation and that public comment was solicited and considered in determining their designation.

(18) (a) The revisions made to Chapters 17-3 and 17-4 and the adoption of Chapter 17-6, F.A.C., are designed to protect the public health or welfare and to enhance the quality of waters of the State. They have been established taking into consideration the use and value of waters of the State for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes, and also taking into consideration their use and value for navigation.

(b) Under the approach taken in the formulation of the rules adopted in this proceeding:

1. These revisions to Chapters 17-3, 17-4 and adoption of Chapter 17-6, F.A.C., are based upon the best scientific knowledge related to the protection of the various designated uses of waters of the state; and,

2. The mixing zone, zone of discharge, exception, exemption, and equitable allocation provisions are designed to provide an opportunity for the future consideration of factors relating to localized situations which could not adequately be addressed in this proceeding, including economic and social consequences, attainability, irretrievable conditions, natural background, and detectability.

(c) This is an even-handed and balanced approach to attainment of water quality objectives. The Commission has specifically recognized that the social, economic and environmental costs may, under certain special circumstances, outweigh the social, economic and environmental benefits if the numerical criteria are enforced statewide. It is for that reason that the Commission has provided for mixing zones, zones of discharge, exceptions, exemptions and other provisions in Chapters 17-3, 17-4, and 17-6. Furthermore, the continued availability of the moderating provisions is a vital factor providing a basis for the Commission's determination that water quality standards applicable to water classes in the rule are attainable taking into consideration environmental, technological, social, economic and institutional factors. The companion provisions of Chapters 17-4 and 17-6 approved simultaneously with these Water Quality Standards are incorporated herein by reference as a substantive part of the State's comprehensive program for the control, abatement and prevention of water pollution.

(d) Without the moderating provisions described in (b)2 above, the Commission would not have adopted the revisions described in (b)1 above nor determined that they are attainable as generally applicable water quality standards.

PART II DEFINITIONS

17-3.021 DEFINITIONS

(1) "Acute Toxicity" shall mean the presence of one or more substances or characteristics or components of substances in amounts which:

(a) are greater than one-third (1/3) of the amount lethal to 50% of the test organisms in 96 hours (96 hr LC_{50}) where the 96 hr LC_{50} is the lowest value which has been determined for a species significant to the indigenous aquatic community; or

(b) may reasonably be expected, based upon evaluation by generally accepted scientific methods, to produce effects equal to those of the concentration of the substance specified in (a) above.

(2) "Background" shall mean the condition of waters in the absence of the activity or discharge under consideration, based on the best scientific information available to the Department.

(3) "Chronic Toxicity" shall mean the presence of one or more substances or characteristics or components of substances in amounts which:

(a) are greater than one-twentieth (1/20) of the amount lethal to 50% of the test organisms in 96 hours (96 hr LC_{50}) where the 96 hr LC_{50} is the lowest value which has been determined for a species significant to the indigenous aquatic community; or

(b) may reasonably be expected, based upon evaluation by generally accepted scientific methods, to produce effects equal to those of the concentration of the substance specified in (a) above.

(4) "Commission" shall mean the Environmental Regulation Commission.

(5) "Compensation Point for Photosynthetic Activity" shall mean the depth at which one percent of the light intensity at the surface remains unabsorbed. This depth shall be computed as two divided by the extinction coefficient.

(6) "Department" shall mean the Department of Environmental Regulation.

(7) "Designated Use" shall mean the present and future most beneficial use of a body of water as designated by the Environmental Regulation Commission by means of the classification system contained in this Chapter.

(8) "Dominance" shall mean the presence of species or communities in greater numbers, biomass, or areal extent than competing species or communities, or a scientifically accepted tendency of species or communities to achieve such a status under existing or reasonably anticipated conditions.

(9) "Effluent Limitation" shall mean any restriction established by the Department on quantities, rates or concentrations of chemical, physical, biological or other constituents which are discharged from sources into waters of the state.

(10) "Exceptional Ecological Significance" shall mean that a water body is a part of an ecosystem of unusual value. The exceptional significance may be in unusual species, productivity, diversity, ecological relationships, ambient water quality, scientific or educational interest, or in other aspects of the ecosystem's setting or processes.

(11) "Exceptional Recreational Significance" shall mean unusual value as a resource for outdoor recreation activities. Outdoor recreation activities include, but are not limited to, fishing, boating, canoeing, water skiing, swimming, scuba diving, and nature observation. The exceptional significance may be in the intensity of present recreational usage, an unusual quality of recreational experience, or possessing a potential for unusual future recreational use or experience.

(12) "Extinction Coefficient" shall mean: (1/D) log10 (S_S/S_D) where D is the length of the light path, S_S is the light intensity at the surface or the transmission value of light through a distilled or deionized water sample of thickness D, and S_D is the light intensity at depth D or the transmission value of light through a sample of the water tested of thickness D. Light intensities or transmission values shall be measured using a cadmium sulfide photoreceptor or other device having a comparable spectral response.

(13) "Groundwater" means water beneath the surface of the ground, whether or not flowing through known and definite channels.

(14) "Natural Background" shall mean the condition of waters in the absence of man-induced alterations based on the best scientific information available to the Department.

(15) "Nuisance Species" shall mean species of flora or fauna whose presence in sufficient number, biomass, or areal extent may reasonably be expected to prevent, or unreasonably interfere with, a designated use of those waters.

(16) "Nursery Area of Indigenous Aquatic Life" shall mean any bed of the following aquatic plants, either in monoculture or mixed: Halodule spp., Halophila Engelmannii, Potamogeton spp., (pondweed), Ruppia maritima, (widgeon-grass), Sagittaria spp. (arrowhead), Syringodium filiforme, (manatee-grass), Thallasia testudinum (turtle grass), or Vallisneria spp., (eel-grass), or any area used by the early-life stages, larvae and post-larvae, of aquatic life during the period of rapid growth and development into the juvenile stages.

(17) "Pollution" shall mean the presence in the outdoor atmosphere or waters of the state of any substances, contaminants, noise, or man-made or man-induced alteration of the chemical, physical, biological or radiological integrity of air or water in quantities or levels which are or may be potentially harmful or injurious to human health or welfare, animal or plant life, or property, including outdoor recreation.

(18) "Predominantly Fresh Waters" shall mean those surface waters in which the specific conductance of the water at the surface is less than 5,000 micromhos per centimeter.

(19) "Predominantly Marine Waters" shall mean those surface waters in which the specific conductance of the water at the surface is greater than or equal to 5,000 micromhos per centimeter.

(20) "Propagation" shall mean reproduction sufficient to maintain the species' role in its respective ecological community.

(21) "Secondary and Tertiary Canals" shall mean any wholly artificial canal or ditch which is behind a control structure and which is part of a water control system that is connected to the works (set forth in Section 373.086, F.S.) of a water management district created under Section 373.069, F.S., and that is permitted by such water management district pursuant to Section 373.103, Section 373.412, or Section 373.416, F.S.

(22) "Secretary" shall mean the Secretary of the Department of Environmental Regulation.

(23) "Shannon-Weaver Diversity Index" shall mean: negative summation (i-1 to S) of (n_i/N) $\log_e$ (N_i/N) where S is the number of species in a sample, N is the total number of individuals in species i.

(24) "Special Waters" shall mean water bodies designated in accordance with 17-3.041 by the Environmental Regulation Commission for inclusion in the Special Waters Category of Outstanding Florida Waters, as contained in Section 17-3.041, Florida Administrative Code. A Special Water may include all or part of any water body.

(25) "Surface Water" means water upon the surface of the earth, whether contained in bounds created naturally or artificially or diffused. Water from natural springs shall be classified as surface water when it exits from the spring onto the earth's surface.

(26) "Waters" shall be as defined in Section 403.031(3), Florida Statutes.

(27) "Zone of Discharge" shall mean a volume underlying or surrounding the point of discharge within which an opportunity for the treatment, mixture or dispersion of wastes into receiving groundwaters has been afforded.

(28) "Zone of Mixing" shall mean a volume of surface water containing the point or area of discharge and within which an opportunity for the mixture of wastes with receiving surface waters has been afforded.

PART III WATER QUALITY CRITERIA

17-3.031 EXCEPTIONS FROM CRITERIA

(1) Upon petition of an affected person, or permit applicant, after public notice and public hearing, and upon affirmnative demonstration that, due to natural or man-induced causes which cannot be controlled or

abated with technology or management practices including zero discharge, certain delineated portions of waters of the State do not meet particular water quality standards contained in this Chapter, the Secretary may issue an order specifically excepting those portions of such waters for which such demonstration has been made.

(2) The petitioner shall affirmatively demonstrate those standards which the petitioner believes more appropriately apply to the waters for which the exception is sought, based upon relevant factors which include, but are not limited to, the designated use of the waters, the extent to which biota have adapted to the background, evidence regarding ecological stress, and adverse impacts on adjoining waters.

(3) The Secretary shall specify, by order, only those criteria which the Secretary determines to have been demonstrated by the preponderance of competent substantial evidence to be more appropriate.

(4) The Department shall modify permits of existing sources affected by the exception in a manner consistent with the Secretary's Order.

(5) Additional relief from criteria established by this Chapter may be provided through exemption pursuant to Section 17-4.243, Florida Administrative Code, or variances as provided for by Section 17-1.57, Florida Administrative Code.

17-3.041 SPECIAL PROTECTION, OUTSTANDING FLORIDA WATERS

(1) It shall be the Department policy to afford the highest protection to Outstanding Florida Waters (a complete listing of which is provided in subsection (3)) which generally include the following surface waters:

(a) waters in National Parks, Wildlife Refuges, and Wilderness Areas; and

(b) waters in the State Park System and Wilderness Areas; and

(c) waters in Environmentally Endangered Lands which have been acquired under Chapter 259, Florida Statutes; and

(d) rivers designated under the Florida Scenic and Wild Rivers Program or the National Wild and Scenic Rivers Act; and

(e) waters within National Seashores, National Marine Sanctuaries, National Estuarine Sanctuaries, and certain National Monuments; and

(f) waters in Aquatic Preserves, created under the provisions of Chapter 258, Florida Statutes; and

(g) waters within the Big Cypress National Freshwater preserve; and

(h) Special Waters as listed in 17-3.041(3)(g). Each water body demonstrated to be of exceptional recreational or ecological significance may be designated as a Special Water. The following procedure shall be used in designating a Special Water after the adoption of this rule:

1. Rulemaking procedures pursuant to Chapter 120, F.S., and Chapter 17-1 shall be followed;

2. At least one fact-finding workshop shall be held in the affected area;

3. All local county or municipal governments and state legislators whose districts or jurisdictions include all or part of a special water shall be notified at least 60 days prior to the workshop in writing by the Secretary;

4. A prominent public notice shall be placed in a newspaper of general circulation in the area of the proposed Special Water at least 60 days prior to the workshop;

5. An economic impact analysis, consistent with Chapter 120, shall be prepared which provides a general analysis of the impact on growth and development including such factors as impacts on planned or potential industrial, agricultural, or other development or expansion; and

6. The Commission may designate a water of the State as a Special Water after making a finding that the waters are of exceptional recreational or ecological significance and a finding that the environmental, social, and economic benefits of the action outweigh the environmental, social, and economic costs.

(2) The policy of this section shall be implemented through the permitting process pursuant to Section 17-4.242.

(3) Outstanding Florida Waters:

(a) *Waters within National Parks*

National Park — County

Everglades — Monroe/Dade/Collier

(b) *Waters within Wildlife Refuges*

Wildlife Refuge — County

Loxahatchee — Palm Beach
Pig Island — Gulf
St. Vicent — Franklin
Chassahowitzka — Citrus/Hernando
Anclote — Pasco
Pinellas — Pinellas
Okeefenokee (Florida Portion) — Baker
Anclote Island — Indian River
Pelican Island — Indian River
Hobe Sound — Martin
Passage Key — Manatee
Caloosahatchee — Lee
Lake Woodruff — Volusia
St. Mark's — Jefferson/Wakulla
National Key Deer — Monroe
Great White Heron — Monroe
Key West — Monroe
Pine Island — Lee
Matlacha Pass — Lee
J. N. "Ding" Darling — Lee
Island Bay — Charlotte
Cedar Keys — Levy
Chinsegut — Hernando
Merritt Island — Volusia/Brevard
Egmont Key — Pinellas
St. John's — Brevard

(c) *Waters within State Parks or Recreation Areas*

State Park or Recreation Area — County

Alfred B. Maclay State Ornamental Garden — Leon
Anastasia State Recreation Area — St. John's

State Park or Recreation Area — County

Bahia Honda State Recreation Area — Monroe
Basin Bayou State Recreation Area — Walton
Bill Baggs Cape Florida State Recreation Area — Dade
Blackwater River State Park — Santa Rosa
Blue Springs State Recreation Area — Volusia
Caladesi Island State Park — Pinellas
Chekika State Recreation Area — Dade
Collier-Seminole State Park — Collier
Dead Lakes State Recreation Area — Gulf
Eden State Ornamental Garden — Walton
Falling Waters State Recreation Area — Washington
Faver-Dykes State Park — St. John's
Flagler Beach State Recreation Area — Flagler
Florida Caverns State Park — Jackson
Fort Clinch State Park — Nassau
Fort Pickens State Park — Escambia
Fred Gannon Rocky Bayou State Recreation Area — Okaloosa
Grayton Beach State Recreation Area — Walton
Highlands Hammock State Park — Highlands/Hardee
Hillsborough River State Park — Hillsborough
Hontoon Island State Park — Volusia/Lake
Hugh Taylor Birch State Recreation Area — Broward
Ichetucknee Springs State Park — Columbia/Swuannees
John Pennekamp Coral Reef State Park — Monroe
John U. Lloyd Beach State Recreation Area — Broward
Jonathan Dickinson State Park — Martin
Lake Griffin State Recreation Area — Lake
Lake Kissimmee — Polk
Little Talbot Island State Park — Duval
Long Key State Recreation Area — Monroe
Manatee Springs State Park — Levy
Mike Roess Gold Head Branch State Park — Clay
Myakka River State Park — Manatee/Sarasota
Ochlockonee River State Park — Wakulla
O'Leno State Park — Alachua/Columbia
Oscar Scherer Recreation Area — Sarasota
Pahokee State Recreation Area — Palm Beach
Pepper Park State Recreation Area — St. Lucie
Ponce de Leon Springs State Recreation Area — Holmes/Walton
Ravine State Ornamental Garden — Putnam
St. Andrews State Recreation Area — Bay
Sebastian Inlet State Recreation Area — Hamilton/Madison/Swuannee
Three Rivers State Recreation Area — Jackson
T.H. Stone Memorial St. Joseph Peninsula State Park — Gulf
Tomoka State Park — Volusia
Torreya State Park — Liberty
Washington Oaks State Ornamental Garden — Flagler
Wekiva Springs State Park — Orange/Seminole

(d) *Waters within Environmentally Endangered Lands which have been Purchased by the State*

Environmentally Endangered Lands — County

Weedon Island — Pinellas
Fakahatchee Strand/Big Cypress Bend — Collier
Volusia Recharge Area — Volusia
River Rise (McLeod Ranch) — Osceola

Environmentally Endangered Lands — County

San Felasco Hammock — Alachua
Three Lakes Ranch — Osceola
Lower Apalachiocola River Tracts — Franklin/Gulf
Palm Beach County Everglades Tract — Palm Beach
Paynes Prairie State Preserve Addition — Alachua
Lower Wekiva River Corridor — Lake/Seminole
Cayo Costa North Captiva Islands — Lee
Charlotte Harbor — Charlotte
Big Cypress National Preserve — Collier/Dade/Monroe
Tosahatchee State Preserve — Orange

(e) *Waters Within National Seashores*

National Seashores — County

Gulf Islands — Escambia/Santa Rosa
Canaveral — Brevard/Volusia

(f) *Waters Within State Aquatic Preserves*

Aquatic Preserves — County

Cape Romano — Ten Thousand Islands — Collier
Nassau River — St. John's River Marshes — Nassau/Duval
St. Joseph Bay — Gulf
Apalachicola Bay — Franklin
North Fork, St. Lucie — St. Lucie/Martin
Intracoastal Waters-Jensen Beach to Jupiter Inlet — Martin/Palm Beach
Loxahatchee River — Lake Worth Creek — Martin/Palm Beach
Fort Clinch State Park — Nassau
Cockroach Bay — Hillsborough
Boca Ciega Bay — Pinellas
Caladesi Island — Pinellas
St. Martin's Marsh — Citrus
Alligator Harbor — Franklin
Biscayne Bay — Dade/Monroe
Estero Bay — Lee
Pellicer Creek — St. John's/Flagler
Tomoka Marsh — Volusia/Flagler
Compon Bight — Monroe
Lignumvitae Key — Monroe
Cape Haze — Gasparilla Sound — Charlotte/Lee
Pine Island Sound — Lee
Matlacha Pass — Lee
Yellow River Marsh — Santa Rosa
Fort Pickens State Park — Escambia
Lake Jackson — Leon
St. Andrew's State Park — Bay
Rocky Bayou State Park — Okaloosa
Mosquito Lagoon — Volusia/Brevard
Banana River — Brevard
Indian River — Malabar to Sebastian — Brevard/Indian River
Indian River — Vero Beach to Ft. Pierce — Indian River/River/St. Lucie
Pinellas County — Pinellas

(g) *Special Waters*

Special Water

Ochlockonee River
Wakulla River

St. Mark's River — except that part between Rattlesnake Branch and the confluence of the St. Mark's and Wakulla Rivers.
Wacissa River
Aucilla River
Apalachicola River south of northern Gulf County Line
Chipola River
Shoal River
Choctawhatchee River
Blackwater River
Perdido River
Suwannee River — except that this designation shall automatically lapse two (2) years from the effective date of this section for that portion of the Suwannee River between State Road 6, Hamilton and Columbia Counties, and Suwannee Springs, Hamilton and Suwannee Counties, unless the Commission, in accordance with the procedural and substantive requirements set forth in Section 17-3.041(1)(h), acts to continue the designation of that portion of the Suwannee River as a Special Water prior to two (2) years from the effective date of this section. The Commission shall initiate and complete such proceedings within two (2) years from the effective date of this section. At the request of any interested party the Commission, in the proceedings to continue or modify the designation of that portion of the Suwannee River as a Special Water, will consider the appropriateness of repealing or modifying the designation of any other portion of the Suwannee River not subject to the automatic lapse provision set forth in this section.

(h) *Waters Within National Monuments*

National Monuments — County
Biscayne — Dade

(i) *Waters Within National Marine Sanctuaries*

Marine Sanctuaries — County
Key Largo Coral Reef — Dade

(j) *Waters Within National Estuarine Sanctuaries*

National Estuarine Sanctuaries — County
Rookery Bay — Collier County

17-3.05 THERMAL SURFACE WATER CRITERIA

(1) All discharges or proposed discharges of heated water into receiving bodies of water (RBW) which are controlled by the state shall be subjected to a thorough study to assess the consequences of the discharge upon the environment. The state shall be divided into two general climatological zones: Peninsular Florida, which varies from tropical in nature to temperate but is modified by the peninsular configuration and is the area south of latitude 30 degrees N (excluding Gulf and Franklin Counties); and Northern Florida which is temperate and continental and is the area above latitude 30 degrees N plus the portions of Guld and Franklin Counties which lie below 30 degrees N.

(a) Heated water discharges existing on July 1, 1972:

1. Shall not increase the temperature of the RBW so as to cause substantial damage or harm to the aquatic life or vegetation therein or interfere with beneficial uses assigned to the RBW.

2. Shall be monitored by the discharge to ensure compliance with this rule, and

3. If the Department, pursuant to notice and opportunity for hearing, finds by preponderant evidence that a discharge has caused substantial damage, it may require conversion of such discharge to offstream cooling or approved alternate methods. In making determinations regarding such conversions, the Department may consider:

a. The nature and extent of the existing damage;

b. The projected lifetime of the existing discharge;

c. Any adverse economic and environmental (including non-water quality) impacts which would result from such conversion; and

d. Such other factors as may be appropriate.

(b) Heated water sources proposed for future discharges into RBW controlled by the state shall not increase the water temperature by more than the monthly temperature limits prescribed for the particular type and location of the RBW. New sources shall include all expansions, modifications, alterations, replacements, or repairs which result in an increased output of ten percent (10%) or more of the level of energy production which existed on the date this rule became effective. Water temperatures shall be measured by procedures approved by the Florida Department of Pollution Control (DPC). In all cases where a temperature rise above ambient is allowed and a maximum RBW temperature is also prescribed, the lower of the two limitations shall be the control temperature.

(c) Definitions.

(i) Ambient (natural) temperature of a RBW is the existing temperature of the receiving water at a location which is unaffected by manmade thermal discharges and a location which is also of a depth and exposure to winds and currents which typify the most environmentally stable portions of the RBW.

(ii) Coastal waters shall be all waters in the state which are not classified as fresh waters or as open waters.

(iii) A cooling pond is a body of water enclosed by natural or constructed restraints which has been approved by the Florida DPC for purposes of controlling heat dissipation from thermal discharges.

(iv) An existing heat source is any thermal discharge (a) which is presently taking place, or (b) which is under construction or for which a construction or operating permit has been issued prior to the effective date of this rule.

(v) Fresh waters shall be all waters of the state which are contained in lakes and ponds, or are in flowing streams above the zone in which tidal actions influence the salinity of the water and where the concentration of chloride ions is normally less than 1500 mg/l.

(vi) Open waters shall be waters in the state extending seaward from the most seaward 18-foot depth contour line (three-fathom bottom depth contour) which is offshore from any island; exposed or submerged bar or reef; or mouth of any embayment or estuary which is narrowed by headlands. Contour lines shall be determined from Coast and Geodetic Survey Charts.

(vii) The point of discharge (POD) for a heated water dicharge shall be primarily that point at which the effluent physically leaves its carrying conduit (open or closed), and discharges into the waters of the state, or, in the event it is not practicable to measure temperature at the end of the discharge conduit, a specific point designated by the Florida Department of Pollution Control for that particular thermal discharge.

(viii) Heated water discharges are the effluents from commercial or industrial activities or processes in which water is used for the purpose of transporting waste heat, and which constitute heat sources of one million British Thermal Units per hour (1,000,000 BTU/HR.), or greater.

(ix) Blowdown shall mean the minimum discharge of recirculating cooling water for the purpose of discharging materials contained in the water, the further buildup of which would cause concentrations in amounts exceeding limits established by best engineering practice.

(x) Recirculating cooling water shall mean water which is used for the purpose of removing waste heat and then passed through a cooling system for the purpose of removing such heat from the water and then, except for blowdown, is used again to remove waste heat.

(d) Monthly and Maximum Temperature Limits

(i) Fresh Waters — Heated water with a temperature at the POD more than 5 degrees F higher than the ambient (natural) temperature of any stream shall not be discharged into such stream. At all times under all conditions of stream flow the discharge temperature shall be controlled so that at least two-thirds (2/3) of the width of the stream's surface remains at ambient (natural) temperature. Further, no more than one-fourth (1/4) of the cross-section of the stream at a traverse perpendicular to the flow shall be heated by the discharge. Heated water with a temperature at the POD more than 3 degrees F higher than the ambient (natural) temperature of any lake or reservior shall not be discharged into such lake or reservoir. Further, no heated water with a temperature above 90 degrees F shall be discharged into any fresh waters in Northern Florida regardless of the ambient temperature of the RBW. In Peninsular Florida, heated waters above 92 degrees F shall not be discharged into fresh waters.

(ii) Coastal Waters — Heated water with a temperature at the POD more than 2 degrees F higher than the ambient (natural) temperature of the RBW shall not be discharged into coastal waters in any zone during the months of June, July, August, and September. During the remainder of the year, heated water with a temperature at the POD more than 4 degrees F higher than the ambient (natural) temperature of the RBW shall not be discharged into coastal waters in any zone. In addition, during June, July, August, and September, no heated water with a temperature above 92 degrees F shall be discharged into coastal waters. Further, no heated water with a temperature above 90 degrees F shall be discharged into coastal waters during the period October thru May.

(iii) Open Waters — Heated water with a temperature at the POD up to 17 degrees F above ambient (natural) temperature of the RBW may be discharged from an open or closed conduit into open waters under the following restraints: The surface temperature of the RBW shall not be raised to more than 97 degrees F and the POD must be sufficient distance offshore to ensure that the adjacent coastal waters are not heated beyond the temperatures permitted in such waters.

(iv) Cooling Ponds — The temperature for heated water discharged from a cooling pond shall be measured at the POD from the pond, and the temperature limitation shall be that specified for the RBW.

(e) General.

(i) Daily seasonal temperature variations that were normal to the RBW before the addition of heat from other than natural causes shall be maintained.

(ii) Recapitulation of temperature limitations prescribed above:

ZONE	STREAMS	LAKES	COASTAL		OPEN
			SUMMER	REMAINDER	
NORTH.	90°F Max. AM. +5°F	90°F Max. AM. +3°F	92°F. Max. AM. +2°F	90°F Max. AM. +4°F	97°F Max. AM. +17°
PENIN.	92°F Max. AM. +5°F	92°F Max. AM. +3°F	92°F Mex. AM. +2°F	90°F Max. AM. +4°F.	97°F Max. AM. +17°F

(f) Upon application on a case by case basis, the Department may establish a zone of mixing beyond the POD to afford a reasonable opportunity for dilution and mixture of heated water discharges with the RBW, in the following manner:

(i) Zones of mixing for thermal discharges from non-recirculated cooling water systems and process water systems of new sources shall be allowed if supported by a demonstration, as provided in section 316(a), Public Law 92-500 and regulations promulgated thereunder, including 40 C.F.R. Part 122, by an applicant that the proposed mixing zone will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made and such demonstration has not been rebutted. It is the intent of the board that to the extent practicable, proceedings under this provision should be conducted jointly with proceedings before the federal government under section 316(a), Public Law 92-500.

(ii) Zones of mixing for blowdown discharges from recirculated cooling water systems, and for discharges from non-recirculated cooling water systems of existing sources, shall be established on the basis of the physical and biological characteristics of the RBW.

(iii) When a zone of mixing is established pursuant to this subsection 17-3.05(1)(f), Florida Administrative Code, any otherwise applicable temperature limitations contained in section 17-3.05(1), Florida Administrative Code, shall be met at its boundary; however, the Department may also establish maximum numerical temperature limits to be measured at the POD and to be used in lieu of the general temperature limits in section 17-3.05(1), Florida Administrative Code, to determine compliance by the discharge with the established mixing zone and the temperature limits in section 17-3.05(1), Florida Administrative Code.

17-3.051 MINIMUM CRITERIA FOR ALL WATERS AT ALL TIMES AND ALL PLACES

All waters of the State shall at all places and at all times be free from:

(1) Domestic, industrial, agricultural, or other man-induced non-thermal components of discharges which, alone or in combination with other substances or in combination with other components of discharges (whether thermal or non-thermal);

(a) Settle to form putrescent deposits or otherwise create a nuisance; or

(b) Float as debris, scum, oil, or other matter in such amounts as to form nuisances; or

(c) Produce color, odor, taste, turbidity, or other conditions in such degree as to create a nuisance; or

(d) Are acutely toxic; or

(e) Are present in concentrations which are carcinogenic, mutagenic, or teratogenic to human beings or to significant, locally occurring, wildlife or aquatic species; or

(f) Pose a serious danger to the public health, safety, or welfare.

(2) Thermal components of discharges which, alone, or in combination with other discharges or components of discharges (whether thermal or non-thermal);

(a) Produce conditions so as to create a nuisance; or

(b) Do not comply with applicable provisions of Subsection 17-3.05(1), F.A.C.

17-3.061 SURFACE WATERS: GENERAL CRITERIA

(1) The criteria of surface water quality hereinafter provided shall be applied to all surface waters except within zones of mixing.

(2) A violation of any of the following surface water quality criteria constitutes pollution. Additional, more stringent or alternative criteria than indicated in this paragraph may, however, be specified for individual classes of water under Sections 17-3.091, 17-3.111, 17-3.121, 17-3.131, and 17-3.141 of this Chapter.

(a) Arsenic — shall not exceed 0.05 milligrams per liter (mg/l).

(b) BOD — shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class and, in no case shall it be great enough to produce nuisance conditions.

(c) Chlorides — in predominantly marine waters, the chloride content shall not be increased more than ten percent (10%) above normal background chloride content. Normal daily and seasonal fluctuations in chloride levels shall be maintained.

(d) Chromium — shall not exceed 0.50 milligrams (mg)/l hexavalent or 1.0 milligrams (mg)/l total chromium in effluent discharge and shall not exceed 0.05 milligrams (mg)/l total chromium after reasonable mixing in the receiving water.

(e) Copper — shall not exceed 0.5 milligrams (mg)/l.

(f) Detergents — shall not exceed 0.5 milligrams (mg)/l.

(g) Fluorides — shall not exceed 10.0 milligrams (mg)/l as fluoride ion.

(h) Lead — shall not exceed 0.05 milligrams (mg)/l.

(i) Nutrients — The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this Chapter. Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Section 3.041 of this Chapter and Section 17-4.242.

(j) Oils and Greases;

1. Dissolved or emulsified oils and greases shall not exceed 5.0 milligrams (mg)/l.

2. No undissolved oil, or visible oil defined as iridescence, shall be present to cause taste or odor, or otherwise interfere with the beneficial uses of waters.

(k) pH — pH of receiving waters shall not be caused to vary more than one (1.0) unit above or below natural background pH of the water; the lower value shall not be less than six (6.0) and the upper value shall not be more than eight and one half (8.5).

(l) Phenolic compounds as listed — Chlorinated phenols including trichlorophenols; chlorinated creosols; 2-chlorophenol; 2, 4 - dichlorophenol and pentachlorophenol; 2, 4 - dinitrophenol; phenol — shall not exceed 1.0 micrograms per litre (ug/l) unless higher values are shown not to be chronically toxic. Such higher values shall be approved in writing by the Secretary. Phenolic compounds other than those produced by the natural decay of plant material, named or unnamed, shall not taint the flesh of edible fish or shellfish or produce objectionable taste or odor in a drinking water supply.

(m) Radioactive Substances:

1. Combined radium 226 and 228 — shall not exceed five picocuries per liter.

2. Gross alpha particle activity including radium 226, but excluding radon and uranium — shall not exceed fifteen picocuries per liter.

(n) Specific Conductance — shall not be increased more than 100% above background levels or to a maximum level of 500 micromhos per centimeter in those surface waters in which the specific conductance of the water at the surface is less than 500 micromhos per centimeter; and shall not be increased more than 50% above background level or to a maximum level of 5,000 micromhos per centimeter for predominantly freshwaters as defined in Section 17-3.021 in which the specific conductance of the water at the surface is equal to or greater than 500 micromhos per centimeter.

(o) Substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, animals, or plants — none shall be present.

(p) Substances in concentrations which result in the dominance of nuisance species — none shall be present.

(q) Turbidity — shall not exceed fifty (50) Jackson Units above natural background as related to a standard candle turbidimeter.

(r) Zinc — shall not exceed 1.0 milligrams (mg)/l.

17-3.071 GROUNDWATERS: GENERAL CRITERIA

(1) The groundwater quality standards in this Chapter contain water quality criteria which are applicable to each classification of receiving groundwater outside of a zone of discharge established pursuant to Section 17-4.245.

(2) In addition to any technology-based groundwater effluent limitations required by Department rule, the Department may also specify water quality-based effluent limitations to assure that water quality criteria will be met.

(3) The groundwater quality criteria specified in Sections 17-3.101 or 17-3.151 shall be applied to all groundwaters except within zones of discharge.

(4) A violation of any groundwater criterion contained in Sections 17-3.101 or 17-3.151 constitutes pollution.

(5) These groundwater criteria and other provisions relating to groundwater are an initial but necessary step by the Department in a field in which there exists limited knowledge. In an effort to further refine the state's groundwater quality policy, there is hereby created a Groundwater Quality Task Force which shall meet regularly and report findings and suggestions regarding these groundwater quality standards and associated rule provisions. Said Task Force shall be composed of sixteen persons, with one representative from each of the five water management districts; five representatives from affected industry, five from environmental groups or other groups the Chairman of the Commission shall elect to invite to participate; and one representative from the Department who shall act as Chairman of that Task Force. In developing the proposed revisions, the Task Force shall consider the various geologic and hydrologic provinces of the state; the most beneficial uses of the groundwaters of the state; criteria necessary to protect those uses; and the integration of groundwater quality and quantity management. Said Task Force shall provide written status reports to the Commission quarterly and a final report no later than September 1, 1979. No later than January 31, 1980 the Commission shall consider at a public hearing any proposed revisions.

(6) The Department must attempt to protect the most beneficial uses of the groundwaters of the state to assure continued availability of this invaluable resource. To achieve the necessary protection, specific standards reflecting these beneficial uses are set forth in these Chapters. However, recognizing the complexities and concerns of implementing groundwater standards, the Commission shall review the groundwater standards contained herein, together with the report of the Task Force established pursuant to (5) above at a public hearing no later than January 31, 1980. Unless the Commission affirmatively determines that the groundwater standards remain appropriate, or amends them as it deems necessary, all such groundwater standards shall be repealed effective January 31, 1980. In the event of repeal of groundwater standards pursuant to this subsection, any regulations applicable to groundwaters at the date of the adoption of this section shall apply. Permits issued prior to January 31, 1980 in accordance with such groundwater standards shall remain in full force and effect until such permits expire, are modified, or revoked in accordance with applicable rules and statutes.

17-3.081 CLASSIFICATION OF WATERS, USAGE, RECLASSIFICATION

(1) All waters of the State have been classified according to designated uses as follows:

CLASS I-A — Potable Water Supplies — Surface waters

CLASS I-B — Potable and Agricultural Water Supplies and Storage — Groundwaters

CLASS II — Shellfish Propagation or Harvesting — Surface waters

CLASS III — Recreation, Propagation and Management of Fish and Wildlife — Surface waters

CLASS IV — Agricultural Water Supplies — Surface waters

CLASS V-A — Navigation, Utility and Industrial Use — Surface waters

CLASS V-B — Freshwater Storage, Utility and Industrial Use — Groundwaters

(2) Classification of a water body according to a particular designated use or uses does not preclude utilization of the water for other purposes.

(3) The specific water quality criteria corresponding to each water classification are listed in Sections 17-3.091 to 17-3.151, inclusive.

(4) Water quality classifications are arranged in order of the degree of protection required, with Class I water having generally the most stringent water quality criteria and Class V the least.

(5) Criteria applicable to a classification are designed to maintain the minimum conditions necessary to assure the suitability of water for the designated use of the classification. In addition, applicable criteria are generally adequate to maintain minimum conditions required for the designated uses of less stringently regulated classifications. Therefore, unless clearly inconsistent with the criteria applicable, the designated uses of less stringently regulated classifications shall be deemed to be included within the designated uses of more stringently regulated classifications.

(6) Any person regulated by the Department or having a substantial interest in this Chapter may seek reclassification of waters of the State by filing a petition with the Secretary in the form required by Section 17-1.24, F.A.C.

(7) A petition for reclassification shall reference and be accompanied by the information necessary to support the affirmative finding required in this section to support the proposed reclassification.

(8) All reclassifications of waters of the State shall be adopted, after public notice and public hearing, only upon an affirmative finding by the Environmental Regulation Commission that:

(a) The proposed reclassification will establish the present and future most beneficial use of the waters; and

(b) Such a reclassification is clearly in the public interest.

(9) Reclassification of waters of the State which establishes more stringent criteria than presently established by this Chapter shall be adopted, only upon additional affirmative finding by the Environmental Regulation Commission that the proposed designated use is attainable, upon consideration of environmental, technological, social, economic, and institutional factors.

17-3.091 CRITERIA: CLASS I-A WATERS — POTABLE WATER SUPPLIES — SURFACE WATERS

The criteria listed below are for surface waters designated for use as a potable supply. The standards contained in Sections 17-3.051 and 17-3.061 shall apply to all waters of this class, unless more stringent levels are specified below. The following criteria are to be applied except within zones of mixing:

(1) Alkalinity — shall not be depressed below 20 milligrams per litre ((mg)/l) as $CaCO_3$.

(2) Ammonia (un-ionized) — shall not exceed 0.02 milligrams (mg)/l.

(3) Bacteriological Quality — Coliform group not to exceed 1,000 per 100 milliliters as a monthly average, using either most probable number (MPN) or membrane filter (MF) counts; nor to exceed 1,000 per 100 milliliters in more than 20% of the samples examined during any month; nor exceed 2,400 per 100 milliliters (MPN or MF count) at any time. Based on a minimum of five samples taken over a 30-day period, the fecal coliform bacterial level shall not exceed 200 per 100 milliliters as computed by the log mean, nor shall more than 10% of the total samples taken during any 30-day period exceed 400 per 100 milliliters.

(4) Barium — shall not exceed 1 milligrams (mg)/l.

(5) Beryllium — shall not exceed 0.11 milligrams (mg)/l in waters with a hardness equal to or less than 150 (in milligrams (mg)/l of $CaCO_3$), and shall not exceed 1.10 milligrams (mg)/l in harder waters.

(6) Biological Integrity — the Shannon-Weaver diversity index of benthic macroinvertebrates shall not be reduced to less than 75% of background levels as measured using organisms retained by a U.S. Standard No. 30 sieve and collected and composited from a minimum of three Hester-Dendy type artificial substrate samplers of 0.10 to 0.15 square meters area, each incubated for a period of four weeks.

(7) Cadmium — shall not exceed 0.8 micrograms per litre (*u*g)/l) in a water with a hardness (in milligrams (mg)/l of $CaCO_3$) equal to or less than 150, and shall not exceed 1.2 micrograms (*u*g)/l in harder waters.

(8) Chlorides — shall not exceed two hundred fifty (250) milligrams (mg)/l.

(9) Chlorine (total residual) — shall not exceed 0.01 milligrams (mg)/l.

(10) Copper — shall not exceed 30 micrograms (*u*g)/l.

(11) Cyanide — shall not exceed 5.0 micrograms (*u*g)/l.

(12) Dissolved Gases — shall not exceed 110% of the saturation value for gases at the existing atmospheric and hydrostatic pressure.

(13) Dissolved Oxygen — shall not be less than 5 milligrams (mg)/l. Normal daily and seasonal fluctations above this level shall be maintained.

(14) Dissolved Solids — not to exceed five hundred (500) milligrams (mg)/l as a monthly average or exceed one thousand (1,000) milligrams (mg)/l at any time.

(15) Fluorides — shall not exceed 1.5 milligrams (mg)/l.

(16) Iron — shall not exceed 0.3 milligrams (mg)/l.

(17) Lead — shall not exceed .03 milligrams (mg)/l.

(18) Mercury — shall not exceed 0.2 micrograms (*u*g)/l.

(19) Nickel — shall not exceed 0.1 milligrams (mg)/l.

(20) Nitrate — shall not exceed 10 milligrams (mg)/l as N or that concentration determined in (21) below.

(21) Nutrients — In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora and fauna.

(22) Pesticides and Herbicides.

(a) Aldrin plus Dieldrin — shall not exceed 0.003 micrograms (*u*g/l.

(b) Chlordane — shall not exceed 0.01 micrograms (*u*g)/l.

(c) 2-4-D — shall not exceed 100 micrograms (*u*g)/l.

(d) 2,4,5-TP — shall not exceed 10 micrograms (*u*g)/l.

(e) DDT — shall not exceed 0.001 micrograms (*u*g)/l.

(f) Demeton — shall not exceed 0.1 micrograms (*u*g)/l.

(g) Endosulfan — shall not exceed 0.003 micrograms (*u*g)/l.

(h) Endrin — shall not exceed 0.004 micrograms (*u*g)/l.

(i) Guthion — shall not exceed 0.01 micrograms (*u*g)/l.

(j) Heptachlor — shall not exceed 0.001 micrograms (*u*g)/l.

(k) Lindane — shall not exceed 0.01 micrograms (*u*g)/l.

(l) Malathion — shall not exceed 0.1 micrograms (*u*g)/l.

(m) Methoxychlor — shall not exceed 0.03 micrograms (*u*g)/l.

(n) Mirex — shall not exceed 0.001 micrograms (*u*g)/l.

(o) Parathion — shall not exceed 0.04 micrograms (*u*g)/l.

(p) Toxaphene — shall not exceed 0.005 micrograms (*u*g)/l.

(23) Phthalate Esters — shall not exceed 3.0 micrograms (*u*g)/l.

(24) Polychlorinated Biphenyls — shall not exceed 0.001 micrograms (*u*g)/l.

(25) Selenium — shall not exceed 0.01 milligrams (mg)/l.

(26) Silver — shall not exceed 0.07 micrograms (*u*g)/l.

(27) Transparency — the depth of the compensation point for photosynthetic activity shall not be reduced by more than 10% as compared to the natural background value.

(28) Zinc — shall not exceed 0.03 milligrams (mg)/l.

17-3.101 CRITERIA: CLASS I-B WATERS — POTABLE AND AGRICULTURAL WATER SUPPLIES AND STORAGE — GROUNDWATERS

As stated in Section 17-3.161, all groundwaters with total dissolved solids levels of less than 10,000 milligrams per litre ((mg)/l) are classified as Class I-B. The criteria contained in Section 17-3.071 apply to all waters in this classification unless more stringent levels are specified below. The criteria contained in Section 17-3.051(1) and the following criteria are to be applied except within zones of discharge:

(1) Arsenic — shall not exceed 0.05 milligrams (mg)/l.

(2) Barium — shall not exceed 1.0 milligrams (mg)/l.

(3) Cadmium — shall not exceed 0.01 milligrams (mg)/l.

(4) Chromium — shall not exceed 0.05 milligrams (mg)/l.

(5) Endrin — shall not exceed 0.2 micrograms per litre (*u*g)/l.

(6) Fluorides — shall not exceed 1.5 milligrams (mg)/l unless background information indicates prior existence of higher levels than 1.5 milligrams (mg)/l, in which case those higher levels are not to be exceeded.

(7) Lindane — shall not exceed 0.004 milligrams (mg)/l.

(8) Lead — shall not exceed 0.05 milligrams (mg)/l.

(9) Mercury — shall not exceed 0.002 milligrams (mg)/l.

(10) Methoxychlor — shall not exceed 0.1 milligrams (mg)/l.

(11) Nitrate — shall not exceed 10.0 milligrams (mg)/l as N.

(12) Radioactive Substances:

(a) Combined radium 226 and 288 — shall not exceed five picocuries per liter.

(b) Gross alpha particle activity including radium 226, but excluding radon and uranium — shall not exceed fifteen picocuries per liter.

(13) Selenium — shall not exceed 0.01 milligrams (mg)/l.

(14) Silver — shall not exceed 0.05 milligrams (mg)/l.

(15) Substances shall not be present in concentrations which injure, are chronically toxic to, or produce significant adverse physiological or behavioral responses in humans, animals, or plants.

(16) 2,4-D — shall not exceed 0.1 milligrams (mg)/l.

(17) 2,4,5-TP — shall not exceed 0.01 milligrams (mg)/l.

(18) Toxaphene — shall not exceed 0.005 milligrams (*u*g)/l.

17-3.111 CRITERIA: CLASS II WATERS — SHELLFISH PROPAGATION OR HARVESTING — SURFACE WATERS

The criteria listed below are for surface waters classified as Class II. The standards contained in Section 17-3.051 and 17-3.061 also shall apply to all waters of this class, unless additional or more stringent levels are specified below. The following criteria are to be applied except within zones of mixing:

(1) Aluminum — shall not exceed 1.5 milligrams ((mg)/l).

(2) Antimony — shall not exceed 0.2 milligrams (mg)/l.

(3) Bacteriological Quality — the median coliform MPN (Most Probable Number) of water shall not exceed seventy (70) per hundred (100) milliliters, and not more than ten percent (10%) of the samples shall exceed a MPN of two hundred and thirty (230) per one hundred (100) milliliters. The fecal coliform bacterial level shall not exceed a median value of 14 MPN per 100 milliliters with not more than ten percent (10%) of the samples exceeding 43 MPN per 100 milliliters.

(4) Biological Integrity — the Shannon-Weaver diversity index of benthic macroinvertebrates shall not be reduced to less than 75% of established background levels as measured using organisms retained by a U.S. Standard No. 30 sieve and collected and composited from a minimum of three natural substrate samples, taken with Ponar type samplers with minimum sampling areas of 225 square centimeters.

(5) Bromine and Bromates — free (molecular) bromine shall not exceed 0.1 milligrams (mg)/l, and bromates shall not exceed 100 milligrams (mg)/l.

(6) Cadmium — shall not exceed 3.0 micrograms (μg)/l).

(7) Chlorine (total residual) — shall not exceed 0.01 milligrams (mg)/l.

(8) Copper — shall not exceed 0.015 milligrams (mg)/l.

(9) Cyanide — shall not exceed 5.0 micrograms (μg)/l.

(10) Dissolved Gases — shall not exceed 110% of the saturation value for gases at the existing atmospheric and hydrostatic pressures.

(11) Dissolved Oxygen — the concentration in all waters shall not average less than 5 milligrams (mg)/l in a 24-hour period and shall never be less than 4 milligrams (mg)/l. Normal daily and seasonal fluctuations above these levels shall be maintained.

(12) Fluorides — shall not exceed 1.5 milligrams (mg)/l.

(13) Iron — shall not exceed 0.3 milligrams (mg)/l.

(14) Manganese — shall not exceed 0.1 milligrams (mg)/l.

(15) Mercury — shall not exceed 0.1 micrograms (μg)/l.

(16) Nickel — shall not exceed 0.1 milligrams (mg)/l.

(17) Nutrients — In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora and fauna.

(18) Odor — threshold odor number not to exceed 24 at 60 degrees C as a daily average.

(19) Pesticides and Herbicides:

(a) Aldrin plus Dieldrin — shall not exceed 0.003 micrograms (μg)/l.

(b) Chlordane — shall not exceed 0.004 micrograms (μg)/l.

(c) DDT — shall not exceed 0.001 micrograms (μg)/l.

(d) Demeton — shall not exceed 0.1 micrograms (μg)/l.

(e) Endosulfan — shall not exceed 0.001 micrograms (μg)/l.

(f) Endrin — shall not exceed 0.004 micrograms (μg)/l.

(g) Guthion — shall not exceed 0.01 micrograms (μg)/l.

(h) Heptachlor — shall not exceed 0.001 micrograms (μg)/l.

(i) Lindane — shall not exceed 0.004 micrograms (μg)/l.

(j) Malathion shall not exceed 0.1 micrograms (μg)/l.

(k) Methoxychlor — shall not exceed 0.03 micrograms (μg)/l.

(l) Mirex — shall not exceed 0.001 micrograms (μg)/l.

(m) Parathion — shall not exceed 0.04 micrograms (μg)/l.

(n) Toxaphene — shall not exceed 0.005 micrograms (μg)/l.

(20) pH — pH shall not be caused to vary more than one (1.0) unit above or below normal pH of coastal waters as defined in Section 17-3.021 and not more than two-tenths (0.2) unit above or below normal pH of open waters as defined in Section 17-3.021 and lower value shall not be less than six and one-half (6.5) and the upper value not more than eight and one-half (8.5).

(21) Phosphorus (elemental) — shall not exceed 0.1 micrograms (μg)/l.

(22) Polychlorinated Biphenyls — shall not exceed 0.001 micrograms (μg)/l.

(23) Selenium — shall not exceed 0.025 milligrams (mg)/l.

(24) Silver — shall not exceed 0.05 micrograms (μg)/l.

(25) Transparency — the depth of the compensation point for photosynthetic activity shall not be reduced by more than 10% as compared to the natural background value.

17-3.121 CRITERIA: CLASS III WATERS — RECREATION — PROPAGATION AND MANAGEMENT OF FISH AND WILDLIFE — SURFACE WATERS

The criteria listed below are for surface waters classified as Class III. The standards contained in Sections 17-3.051 and 17-3.061 also apply to all waters of this classification, unless additional or more stringent criteria are specified below. The following criteria are to be applied except within zones of mixing.

(1) Alkalinity — shall not be depressed below 20 milligrams per litre ((mg)/l) as $CaCO_3$ in predominantly fresh waters.

(2) Aluminum — shall not exceed 1.5 milligrams (mg)/l in predominantly marine waters.

(3) Ammonia (un-ionized) — shall not exceed 0.02 milligrams (mg)/l in predominantly fresh waters.

(4) Antimony — shall not exceed 0.2 milligrams (mg)/l in predominantly marine waters.

(5) Bacteriological Quality — fecal coliform bacteria shall not exceed a monthly average of 200 per 100 ml of sample, nor exceed 400 per 100 ml of sample in 10 percent of the samples, nor exceed 800 per 100 ml on any one day, nor exceed a total coliform bacteria count of 1,000 per 100 ml as a monthly average, nor exceed 1,000 per 100 ml in more than 20 percent of the samples examined during any month, nor exceed 2,400 per 100 ml at any time. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period. Either MPN or MF counts may be utilized.

(6) Beryllium — in predominantly fresh waters shall not exceed 0.011 milligrams (mg)/l in waters with a hardness equal to or less than 150 (in milligrams (mg)/l of $CaCO_3$) and shall not exceed 1.10 milligrams (mg)/l in harder waters.

(7) Biological Integrity — the Shannon-Weaver diversity index of benthic macroinvertebrates shall not be reduced to less than 75 percent of established background levels as measured using organisms retained by a U.S. Standard No. 30 sieve and, in predominantly fresh waters, collected and composited from a minimum of three Hester-Dendy type artificial substrate samplers of 0.10 to 0.15 m^2 area each incubated for a period of four weeks, and in predominantly marine waters, collected and composited from a minimum of three natural substrate samples, taken with Ponar type samplers with minimum sampling area of 225 square centimeters.

(8) Bromine and Bromates — free (molecular) bromine shall not exceed 0.1 milligrams (mg)/l in predominantly marine waters, and bromates shall not exceed 100 milligrams (mg)/l in predominantly marine waters.

(9) Cadmium — shall not exceed 5.0 micrograms per litre (μg)/l in predominantly marine waters, shall not exceed 0.8 micrograms (μg)/l in predominantly fresh waters in water with a hardness (in milligrams (mg)/l of $CaCO_3$) of less than 150, and shall not exceed 1.2 micrograms (μg)/l in harder waters.

(10) Chlorine (total residual) — shall not exceed 0.01 milligrams (mg)/l.

(11) Copper — shall not exceed .015 milligrams (mg)/l in predominantly marine waters; shall not exceed .03 milligrams (mg)/l in predominantly fresh waters.

(12) Cyanide — shall not exceed 5.0 micrograms (μg)/l.

(13) Dissolved Gases — shall not exceed 110% of the saturation value for gases at the existing atmospheric and hydrostatic pressures.

(14) Dissolved Oxygen — in predominantly fresh waters, the concentration shall not be less than 5 milligrams (mg)/l. In predominantly marine waters, the concentration shall not average less than 5 milligrams (mg)/l in a 24-hour period and never less than 4

milligrams (mg)/l. Normal daily and seasonal fluctuations above these levels shall be maintained in both predominantly fresh waters and predominantly marine waters.

(15) Fluorides — shall not exceed 5.0 milligrams (mg)/l in predominantly marine waters.

(16) Iron — shall not exceed 1.0 milligrams (mg)/l in predominantly fresh waters; 0.3 milligrams (mg)/l in predominantly marine waters.

(17) Lead — shall not exceed .03 milligrams (mg)/l in predominantly fresh waters.

(18) Mercury — shall not exceed 0.1 micrograms (μg)/l in predominantly marine waters; shall not exceed 0.2 micrograms (μg)/l in predominantly fresh waters.

(19) Nickel — shall not exceed 0.1 milligrams (mg)/l.

(20) Nutrients — In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna.

(21) Pesticides and Herbicides:

(a) Aldrin plus Dieldrin — shall not exceed 0.003 micrograms (μg)/l.

(b) Chlordane — shall not exceed 0.01 micrograms (μg)/l in predominantly fresh waters and 0.004 micrograms (μg)/l in predominantly marine waters.

(c) DDT — shall not exceed 0.001 micrograms (μg)/l.

(d) Demeton — shall not exceed 0.1 micrograms (μg)/l.

(e) Endosulfan — shall not exceed 0.003 micrograms (μg)/l in predominantly fresh waters and 0.001 micrograms (μg)/l in predominantly marine waters.

(f) Endrin — shall not exceed 0.004 micrograms (μg/l.

(g) Guthion — shall not exceed 0.01 micrograms (μg)/l.

(h) Heptachlor — shall not exceed 0.001 micrograms (μg)/l.

(i) Lindane — shall not exceed 0.01 micrograms (μg)/l in predominantly fresh waters and 0.004 micrograms (μg)/l in predominantly marine waters.

(j) Malathion — shall not exceed 0.1 micrograms (μg)/l.

(k) Methoxychlor — shall not exceed 0.03 micrograms (μg)/l.

(l) Mirex — shall not exceed 0.001 micrograms (μg)/l.

(m) Parathion — shall not exceed 0.04 micrograms (μg)/l.

(n) Toxaphene — shall not exceed 0.005 micrograms (μg)/l.

(22) pH — pH of receiving waters shall not be caused to vary more than one (1.0) unit above or below normal pH of predominantly fresh waters and coastal waters as defined in Section 17-3.021; and not more than two tenths (0.2) units above or below normal pH of open waters as defined in Section 17-3.021; the lower value shall not be less six (6.0) in predominantly fresh waters or less than six and one-half (6.5) in predominantly marine waters; and the upper value not more than eight and one-half (8.5).

(23) Phosphorus (elemental) — shall not exceed 0.1 micrograms (μg/l in predominantly marine waters.

(24) Phthalate Esters shall not exceed 3.0 micrograms (μg/l in predominantly fresh waters.

(25) Polychlorinated Biphenyls — shall not exceed 0.001 micrograms (ug)/l.

(26) Selenium — shall not exceed 0.025 milligrams (mg)/l.

(27) Silver — shall not exceed 0.07 micrograms (ug)/l in predominantly fresh waters and 0.05 micrograms (μg)/l in predominantly marine waters.

(28) Transparency — the depth of the compensation point for photosynthetic activity shall not be reduced by more than 10 percent compared to the natural background value.

(29) Zinc — shall not exceed .03 milligrams (mg)/l in predominantly fresh waters.

17-3.131 CRITERIA: CLASS IV WATERS — AGRICULTURAL SUPPLIES — SURFACE WATERS

The criteria listed below are for surface waters classified as Class IV. The standards established in Sections 17-3.051 and 17-3.061 also apply to all waters of this classification, unless additional or more stringent criteria are specified below. The following criteria are to be applied except within zones of mixing.

(1) Alkalinity — shall not exceed 600 milligrams (mg)/l as $CaCO_3$.

(2) Beryllium — shall not exceed 0.1 milligrams (mg)/l in waters with a hardness in milligrams (mg)/l of $CaCO_3$ of less than 150 and shall not exceed 0.5 milligrams (mg)/l in harder waters.

(3) Boron — shall not exceed 0.75 milligrams (mg)/l.

(4) Color, odor, and taste producing substances and other deleterious substances, including other chemical compounds, attributable to domestic wastes, industrial wastes, and other wastes — only such amounts as will not render the waters unsuitable for agricultural irrigation, livestock watering, industrial cooling, industrial process water supply purposes or fish survival.

(5) Cyanide — shall not exceed 5.0 micrograms (ug)/l.

(6) Dissolved Oxygen — shall not average less than 4.0 milligrams (mg)/l in a 24-hour period and shall never be depressed below 3.0 milligrams (mg)/l.

(7) Iron — shall not exceed 1.0 milligrams (mg)/l.

(8) Mercury — shall not exceed 0.2 micrograms (ug/l.

(9) Nickel — shall not exceed 0.1 milligrams (mg)/l.

(10) pH — not more than (1.0) unit from the normal or not less than six (6.0) nor greater than 8.5.

17-3.141 CRITERIA: CLASS V-A WATERS — NAVIGATION, UTILITY AND INDUSTRIAL USE — SURFACE WATERS.

The criteria listed below are for surface waters classified as Class V-A. The standards contained in Sections 17-3.051 and 17-3.061 also apply to all waters of this classification unless additional, alternative or more stringent criteria are specified below. The following criteria are to be applied except within zones of mixing:

(1) Cyanide — shall not exceed 5.0 micrograms per litre (ug)/l).

(2) Dissolved Oxygen — not to be depressed below 2.0 milligrams per litre ((mg)/l).

(3) Mercury — shall not exceed 0.2 micrograms (ug)/l.

(4) Odor producing substances — only in such amounts as will not unreasonably interfere with the use of the water for the designated purpose of this classification.

(5) pH — not lower than 5.0 nor greater than 9.5 except certain swamp waters which may be as low as 4.5.

17-3.151 CRITERIA: CLASS V—B WATERS — FRESHWATER STORAGE AND UTILITY AND INDUSTRIAL SUPPLY — GROUNDWATERS

As state in Section 17-3.161, all groundwaters with total dissolved solids equal to or greater than 10,000 milligrans per litre (mg)/l) are classified as Class V-B, Except within zones of discharge.

(1) The standards contained in 17-3.051(1) and 17-3.071 apply to all waters of this classification, and

(2) The standards contained in 17-3.101 apply to waters of this classification that are used for or can reasonably be expected to be used for a potable supply.

17-3.161 CLASSIFIED WATERS

(1) The surface waters of the State of Florida are classified by river basins or sub-basins as Class III — Recreation — Propagation and Management of Fish and Wildlife, with only the individual exceptions to Class III listed within each basin as delineated on USGS Map, "Drainage Basins in Florida", Map Series No. 28, October 1967. Outstanding Florida Waters are listed in Section 17-3.041. All secondary and tertiary canals wholly within agricultural areas are hereby classified as Class IV, and are not listed below. Agricultural areas shall generally include lands actively used solely for the production of food and fiber which are zoned for agricultural use where county zoning is in effect. Agricultural areas exclude lands which are platted and subdivided or in a transition phase to residential use.

(2) The groundwaters of the State of Florida are classified on the basis of total dissolved solids content. Groundwaters with levels of total dissolved solids less than 10,000 mg/l are classified as Class I-B, and groundwaters with naturally-occurring levels of total dissolved solids equal to or greater than 10,000 mg/l are classified as Class V-B. These waters are not listed below.

(3) Florida Water Classifications

(a) Nassau — St. Mary's Basin (No. 19)

This basin consists of U.S. Geological Survey Basins 09J — St. Mary's River Basin and coastal area and 09D — Coastal area between St. Mary's River and St. John's River and lists wholly or partially in the following counties: Nassau, Baker, Columbia, Union and Duval (consolidated city of Jacksonville). The following individual waters are exceptions to Class III:

1. Nassau County. South Amelia River — Nassau River north Harrison Creek — Class II. Alligator Creek — Class II.

2. Nassau County and Duval County. Nassau River and Creek — Nassau Sound to Seymore Point — Class II.

3. Duval County (Consolidated City of Jacksonville). Pumpkinhill Creek — Class II. Intracoastal Waterway and tributaries — confluence of Nassau and Amelia Rivers south to Flashing Marker "72", thence eastward along Ft. George River to Ft. George Inlet and includes Garden Creek and both prongs of Simpson Creek — Class II.

(b) St. John's Basin (No. 20). This basin consists of U.S. Geological Survey Basin 09E — St. John's River basin and Sub-basins 09E1 — St. John's River above Oklawaha River, 09E2 — Oklawaha River, and 09E3 — St. John's River below Oklawaha River, and lies wholly or partially in the following counties: Duval (Consolidated City of Jacksonville), St. John's, Clay, Bradford, Alachua, Putnam, Flagler, Volusia, Marion, Levy, Lake, Sumter, Seminole, Orange, Brevard, Osceola, Polk, Indian River, Okeechobee and St. Lucie. The following individual waters are exceptions to Class III:

1. Brevard County and Indian River County. St. John's River and Tributaries — Lake Washington Dam south through and including Sawgrass Lake, Lake Hellen Blazes, and Blue Cypress Lake to SR 60 in Indian River County — Class I-A.

2. Duval County. Ft. George River — Ft. George Inlet north to Nassau — St. Mary's/St. John's Basin Boundary. Class II.

(c) Suwannee Basin (No. 21). This basin consists of U.S. Geological Survey Basin 09J — Suwannee River Basin and Sub-basins, 09J1 — Suwannee River above Withlacoochee River, 09J2 — Alapaha River, 09J3 — Withlacoochee River, 09J5 — Suwannee River below Withlacoochee River, and 09J6 — Santa Fe River and lies wholly or partially in the following counties: Madison, Hamilton, Columbia, Baker, Union, Bradford, Clay, Alachua, Gilchrist, Suwannee, Lafayette, Dixie, Taylor and Levy. The following individual waters are exceptions to Class III:

1. Dixie County. Tidal Creeks within USGS Sub-basin 09J5 north of, but excluding the mouth of, the Suwannee River from Suwannee River or Gulf of Mexico to source — Class II.

2. Levy County. Tidal Creeks within USGS Sub-basin 09J5 south of, but excluding the mouth of, the Suwannee River from Suwannee River or Gulf of Mexico to source — Class II.

3. Hamilton County. Jumping Gully Creek — Unclassified.

(d) Aucilla — Ochlockonee — St. Mark's Basin (No. 22). This basin consists of U.S. Geological Survey Basins 09K — Aucilla River Basin, 11B — Coastal area between Aucilla River and Ochlockonee River, 11C — Ochlockonee River basin and coastal areas, and 11D — Coastal area between Ochlockonee River and Apalachicola River and lies wholly or partially in the following counties: Gadsden, Leon, Jefferson, Madison, Liberty, Franklin, Wakulla, Taylor, Lafayette, and Dixie. The following individual waters are exceptions to Class III.

1. Gadsden County. Quincy Creek — SR 65 to source — Class I-A Holman Branch — SR 270-A to source — Class I-A.

2. Franklin County. Ochlockonee Bay — Confluence of Sopchoppy and Ochlockonee Rivers to Gulf of Mexico — Class II. Alligator Harbor — East from a line from Peninsula Point north to St. James Island to mean high water — Class II. Gulf of Mexico — North of a line from

Peninsula Point on Alligator Point to the northeastern tip of Dog Island and bounded on the east by Alligator Harbor and on the west by St. George Sound — Class II. St. George Sound (Portion in USGS Basin 11D) — Gulf of Mexico westerly to Apalachicola Bay — Class II. East Bay and Tributaries (Portion in USGS Basin 11D) — Apalachicola Bay to source — Class II.

3. Wakulla County. Oyster Bay, Apalachee Bay, and Tributaries — west of a line from western tip of Shell Point south to FL. 4 sec. marker and southerly to Ochlockonee Point, with the exception of Spring Creek and portion of King Bay west and north of a line from western-most tip of Porter Island south to Hungry Point — Class II.

4. Jefferson County and Wakulla County. Coastal waters — Mouth of Aucilla River west to Live Oak Point excluding mouths of drainage areas — Class II.

5. Taylor County. Fenholloway River — Class V-A.

6. Dixie County. Tidal Creeks and coastal waters — Horseshoe Point south to basin boundary of USGS Basin 09K — Class II.

(e) Withlacoochee Basin (No. 23). This basin consists of U.S. Geological Survey basins 09H — Coastal area between the Withlacoochee River Basin and Suwannee River and lies wholly or partially in the following counties: Gilchrist, Levy, Alachua, Marion, Citrus, Sumter, Hernando, Pasco, Lake and Polk. The following individual waters are exceptions to Class III:

1. Levy County. Tidal Creeks and coastal waters — South from USGS Basin boundary line 09H separating the Suwanee Basin from the Withlacoochee Basin to the Withlacoochee River excluding the Cedar Key area and the mouth of the Withlacoochee River — Class II.

(f) Tampa Bay Area Basin (No. 24). This basin consists of U.S. Geological Survey Basins 10J — Coastal area between Withlacoochee River and Hillsborough River, 10H — Hillsborough River Basin and coastal area north of Alafia River, 10G — Alafia River Basin and 10F — Coastal area between Alafia River and Myakka River and lies wholly or partially in the following counties: Citrus, Hernando, Pasco, Pinellas, Hillsborough, Polk, Manatee, Sarasota, Charlotte, and Lee. The following individual waters are exceptions to Class III:

1. Citrus County. Tidal Creeks and coastal waters — Latitude 28° 54' N., south to Hernando County Line with the exception of waters which are bounded by and including the Crystal River on the north, St. Martin's River on the south, barrier islands on the west, and the mainland on the east — Class II.

2. Pinellas County. Mullet Key Area — Class II. Tampa Bay — South Pinellas County Line to Gandy Causeway — Class II. Old Tampa Bay — Gandy Causeway to Safety Harbor — Class II. Safety Harbor — To Old Tampa Bay — Class II. Mobbly Bay — Portion in Pinellas County — Class II.

3. Hillsborough County. Old Tampa Bay and Mobbly Bay — Beginning at the intersection of the north shore of SR 60 (Courtney Campbell Parkway) and Longitude 83° 35' 45" west, thence due north to the line of mean high water, thence westward along the line of mean high water, including Rocky and Double Branch Creeks to SR 580 and up the upper Tampa Bay watershed canal to a line connecting the lines of mean high water on the outer sides of the canal banks, to the county line, thence southerly along the county line to SR 60, thence along the north shore of SR 60 to the point of beginning — Class II. Old Tampa Bay — All waters within Hillsborough County bounded on the north by SR 60 (Courtney Campbell Parkway), the south by Interstate 4 (Howard Franklin Bridge), the west by the county line, and the east by the line of mean high water — Class II. Tampa Bay — Beginning at Gadsden Point, thence along a line connecting Gadsden Point and the intersection of Gadsden Point Cut and Cut "A" to a point one-half nautical mile inside said intersection, thence westward along a line one-half nautical mile inside and parallel to Gadsden Point Cut, Cut "G," Cut "J," Cut "J2," and Cut "K," to the line of mean high water, thence along the line of mean high water to the point of beginning — Class II. Tampa Bay — Beginning at the intersection of the Hillsborough County Line and the line of mean high water, thence to the rear range marker of Cut "D," thence northerly along the line of Cut "D" range to a point one-half nautical mile inside the southern boundary of Cut "C", thence along a line one-half mile inside and parallel to Cut "C", Cut "D", and Cut "E" to a point with Latitude 27°45'40" N. and Longitude 82°30'40" west, thence to a point Latitude 27°47' north and Longitude 82°27' west, thence on a true bearing of 140° to the line of mean high water, thence along the line of mean high water to the western tip of Mangrove Point, thence to the northwestern tip of Tropical Island, thence eastward along the line of mean high water to the eastern tip of Goat Island, thence due south to the line of mean high water, thence along the line of mean high water to the point of beginning — Class II. Tampa Bay — Hillsborough County portion west of the Sunshine Skyway and from the three fathom depth contour up to the line of mean high water — Class II. Hillsborough River — City of Tampa Water Treatment Plant Dam to Flint Creek — Class I-A. Cow House Creek — Hillsborough River to source — Class I-A.

4. Manatee County — Terra Cela Bay — To Terra Cela Point — Class II. Palma Sola Bay — Class II. Passage Key Area — Eqmont Key to Anna Maria Island — Class II. Sarasota Bay — East-west line through marker "48" on Intracoastal Waterway south to Manatee County Line — Class II. Manatee River — Rye Bridge Road to Bethany Vicinity — Class I-A. Ward Lake — SR 70 to source (SR 675) — Class I-A.

5. Sarasota County. Sarasota Bay — West of Center (Intracoastal Waterway) — Class II. Lemon Bay — Forked Creek south to Charlotte County Line — Class II.

6. Charlotte County. Lemon Bay and Tributaries — N. Charlotte County Line south to Placida Harbor and bounded on the east by SR 775 Class II. Placida Harbor — to mean high water — Class II. Gasparilla Sound — Placida Harbor to Charlotte County Line — Class II. Bull Bay — mean high water to Charlotte County Line — Class II. Turtle Bay — mean high water to Charlotte County Line — Class II. Charlotte Harbor — Portion in USGS Basin 10F south to Charlotte County Line — Class II.

7. Lee County. Charlotte Harbor — Portion in USGS Basin 10F south from N. Lee County Line — Class II.

(g) Peace Basin (No. 25). This basin consists of U.S. Geological Survey Basins 10E — Myakka River Basin, 10D — Peace River Basin and 10C — Coastal area between Peace River and Caloosahatchee River and lies wholly or partially in the following counties: Polk, Hillsborough, Manatee, Hardee, Highlands, Sarasota, DeSoto, Charlotte, Glades, and Lee. The following individual waters are exceptions to Class III:

1. Sarasota County. Big Slough Canal — South to U.S. 41 — Class I-A. Myakka River — Myakka vicinity through Upper and Lower Myakka Lakes to Manhattan Farms — Class I-A. Myakka River — S.W. North Port Charlotte Limit south to Charlotte County Line — Class II.

2. DeSoto County. Horse Creek — Vicinity Jct. SR 760 and 761 to Peace River — Class I-A.

3. DeSoto County and Charlotte County. Prairie Creek — Headwaters to Shell Creek — Class I-A.

4. Charlotte County. Myakka River — N. Charlotte County Line south to Charlotte Harbor — Class II. Charlotte Harbor — Portion in Peace Basin south to Charlotte County Line — Class II. Alligator Creek — North and south prongs from headwaters to SR 765-A — Class I-A. Shell Creek Headwaters to Ridge Harbor — Class I-A. Lemon Bay and tributaries — Placida Harbor north to Tampa Bay Area/Peace Basin Boundary, and bounded on the east by SR 775 — Class II. Port Charlotte Canal System — Surface waters lying upstream of, or directly connected to, Fordham Waterway upstream of Conway Boulevard — Class I-A.

5. Lee County. Charlotte Harbor — Portion in USGS Basin 10C north to N. Lee County Line — Class II. Pine Island Sound Charlotte Harbor to San Carlos Bay — Class II. Matlacha Pass — Charlotte Harbor to San Carlos Bay — Class II. San Carlos Bay — Portion in USGS Basin 10C. Class II.

(h) Kissimmee Basin (No. 26). This Basin consists of U.S. Geological Survey Sub-basin 10B1 — Lake Okeechobee inflow area and lies wholly or partially in the following counties: Lake, Orange, Polk, Osceola, Highlands, Okeechobee, Glades Charlotte, Saint Lucie, and Martin. There are no individual exceptions to Class III in this basin.

(i) Florida East Coastal Basin (No. 27). This basin consists of U.S. Geological Survey Basins 09F. Coastal area between St. John's River and Turkey Creek and 10A — Turkey Creek and coastal area south to St. Lucie River and lies wholly or partially in the following counties: Duval (Consolidated City of Jacksonville), St. John's, Flagler, Volusia, Brevard, Indian River, St. Lucie, and Martin. The following individual waters are exeptions to Class III:

1. St. John's County. Tolomato River and Tributaries — From a line connecting Spanish Landing to Booth Landing south to Casa Cola Creek — Class II. Guano River — Guano Lake Dam south to Tolomato River Class II. North River and Intracoastal Waterway — Casa Cola Creek south to Crescent Beach — Class II. Matanzas River (Intracoastal Waterway) — Crescent Beach south to Flagler County Line — Class II.

2. St. John's County and Flagler County. Pellicer Creek — Class II.

3. Flagler County. Matanzas River (Intracoastal Waterway) — N. Flagler County Line south to Fl. Marker "109" — Class II.

4. Volusia County. Indian River North — Channel Marker 57 south to Mosquito Lagoon — Class II. Mosquito Lagoon — Indian River North south to S. Volusia County Line — Class II.

5. Brevard County. Mosquito Lagoon — North Brevard County Line south to Max Hoeck Creek — Class II. Indian River — N. Brevard County Line south to Florida East Coast Railroad Crossing (vicinity Jay Jay) — Class II. Indian River — Barnes Blvd. south to South Section Line of Section 29, T. 26 S., R. 37E., Palm Shores — Class II. Indian River — Cape Malabar south to S. Brevard County Line — Class II. Trout Creek — Class II. Kid Creek — Class II. Goat Creek — Class II.

6. Indian River County. Indian River — Sebastian Inlet (N. Indian River County Line) south to Wabasso vicinity east of channel centerline — Class II. Indian River — Wabasso vicinity south to vicinity North Relief Canal — Class II.

7. St. Lucie County. Indian River — N. St. Lucie County Line south to Garfield Point — Class II. Indian River — Middle Cove vicinity south to S. St. Lucie County Line, east of Channel centerline — Class II.

8. Martin County. Indian River — N. Martin County Line south to St. Lucie Inlet, east of Channel centerline — Class II.

(j) Lower Florida Basin (No. 28). This basin consists of U.S. Geological Survey Sub-basin 10B2 — Lake Okeechobee and the Everglades and lies wholly or partially in the following counties: Charlotte, Glades, Lee, Hendry, Collier, Monroe, Dade, Broward, Palm Beach, Martin, St. Lucie, and Okeechobee. The following individual waters are exceptions to Class III:

1. Lee County. Caloosahatchee River — E. Lee County Line to South Florida Water Management District Structure 79 — Class I-A. San Carlos Bay — Portion in USGS Sub-basin 10B2 — Class II. Matanzas Pass — San Carlos Bay to Estero Bay — Class II. Hell Peckish Bay — Class II.

2. Collier County. Cocohatchee River — Class II. Little Hickory Bay — Class II. Wiggins Pass — Class II. Inner and Outer Clam Bay — Class II. Inner and Outer Doctors Bay — Class II. Connecting Waterways — Wiggins Pass south to Outer Doctors Bay — Class II. Naples Bay — Class II. Dollar Bay — Class II. Tidal Bays and Passes — Rookery Bay south and easterly through Ten Thousand Islands to Monroe County Line — Class II.

3. Monroe County. Monroe County Coastline — North Monroe County Line south and including Florida Bay portion within Everglades National Park — Class II.

4. Dade County. Miami River — Salinity barrier easterly 5.7 miles to Biscayne Bay — Class IV.

5. Broward County. Abandoned Rock Pit — Northeast corner of No. 7 and Prospect Field Road in the S.W. Quarter of Section 7, T. 49 S., R. 42 E. — Class I-A.

6. Palm Beach County. M- Canal L-8 to Lake Mangonia — Class I-A. Lake Mangonia — Class I-A. Clear Lake — Class I-A. Canal C-18 (freshwater portion) — Class I-A. Canal C-18 — Salinity barrier to Loxahatchee River — Class II.

7. Palm Beach County and Martin County. Loxahatchee River — Above Florida East Coast Railroad Bridge including South, Northwest, and North Forks — Class II.

8. Martin County. Great Pocket — St. Lucie River to Peck's Lake — Class II.

9. Multi County. Lake Okeechobee — Class I-A.

(k) Apalachicola Basin (No. 31). This basin consists of U.S. Geological Survey Basins 11E — Apalachicola River Basin and Sub-basins 11E2 — Chattahoochee River below Mulberry Creek, 11E7 — Apalachicola River and 11E8 — Chipola River, and lies wholly or partially in the following counties: Jackson, Gadsden, Washington, Bay, Calhoun, Liberty, Gulf, and Franklin. The following individual waters are exceptions to Class III:

1. Gadsden County. Mosquito Creek — U.S. Highway 90 north to Florida State Line — Class I-A.

2. Franklin County. East Bay — Portion in USGS Sub-basin 11E7 with exception of area encompassed within 2-mile radius from Apalachicola entrance of John Gorrie Memorial Bridge — Class II. Apalachicola Bay — Portion in USGS Sub-basin 11E7 with exception of area encompassed within 2-mile radius of John Gorrie Memorial Bridge — Class II.

(l) Choctawhatchee Basin (No. 32). This basin consists of U.S. Geological Survey Basins 11F — Coastal Area between Apalachicola River and Choctawhatchee River, 12A — Choctawhatchee River Basin, 12B — Coastal area between Choctawhatchee River and Yellow River and Sub-basins 12A3 — Pea River and 12A4 — Choctawhatchee River below Pea River, and lies wholly or partially in the following counties: Jackson, Calhoun, Gulf, Franklin, Holmes, Washington, Bay, Walton, Okaloosa, Santa Rosa, and Escambia. The following individual waters are exceptions to Class III:

1. Jackson County, Washington County, and Bay County. Econfina Creek — Deer Point Impoundment to source — Class I-A.

2. Gulf County. Indian Lagoon — West of Indian Pass and St. Vincent Sound — Class II. St. Joseph Bay — South and west of a line from St. Joseph Point to vicinity Port St. Joe — Class II.

3. Franklin County. St. George Sound (Portion of USGS Basin 11F) — East Pass to Apalachicola Bay — Class II. Apalachicola Bay — Portion in USGS Basin 11F with exception of area encompassed within 2-mile radius from Apalachicola entrance of John Gorrie Memorial Bridge — Class II. St. Vincent Sound — Apalachicola Bay to Indian Pass — Class II.

4. Bay County. East Bay and Tributaries — East of U.S. Highway 98 to, but excluding, Wetappo Creek — Class II. North Bay and Tributaries — North of U.S. Highway 98 to Deer Point Dam excluding Alligator and Fanning Bayous — Class II. West Bay and Tributaries — West of North Bay (line from West Bay Point on the north to Shell Point on the south) except West Bay Creek (northwest of Channel Marker 27C off Goose Point), Crooked Creek (north of a line from Crooked Creek Point to Doyle Point), and Burnt Mill Creek (north of a line from Graze Point to Cedar Point) — Class II. Deer Point Impoundment — Dam to source — Class I-A. Bayou George and Creek — Impoundment to source — Class I-A. Bear Creek — Impoundment to source — Class I-A. Big Cedar Creek — Impoundment to source — Class I-A.

5. Walton County and Okaloosa County. Choctawhatchee Bay and Tributaries — Eastward from a line from White Point southwesterly through Fl. Light Marker "2" of the Intracoastal Waterway, and south of a line from Alaqua Point to Wheeler Point, to the eastern sources — Class II.

6. Okaloosa County. Rocky Bayou — Choctawhatchee Bay to Rocky Creek — Class II. Santa Rosa Sound — Okaloosa/Santa Rosa County Line east to Manatee Point — Class II.

7. Okaloosa County, Santa Rosa County, and Escambia County. Santa Rosa Sound — From a line connecting Gulf Breeze approach to Pensacola Beach, Bascule Bridge, and Sharp Point east to north-south line through Manatee Point with exception of the Navarre Beach area from Channel Marker "109" to Navarre Bridge — Class II.

8. Santa Rosa County. Blackwater Bay (Portion in USGS Basin 12B) — From a line connecting Robinson's Point to Broad River south to East Bay (line due west from Escribano Point) — Class II. East Bay and Tributaries (Portion in USGS Basin 12B) — Blackwater Bay (line due west from Escribano Point) southerly to Pensacola Bay (line from Garcon Point on the North to Redfish Point on the South) — Class II.

(m) Perdido-Escambia Basin (No. 33). This basin consists of U.S. Geological Survey Basin 12C — Yellow River Basin, 12D — Blackwater River Basin and coastal area, 12E — Escambia River Basin and coastal area, and Sub-basins 12E1 — Conecuh River and 12E4 — Escambia River and lies wholly or partially in the following counties: Walton, Okaloosa, Santa Rosa, and Escambia. The following individual waters are exceptions to Class III:

1. Santa Rosa County. Blackwater Bay (Portion in USGS Basins 12C and 12D) — From a line connecting Robinson's Point to Broad River south to East Bay (line due west from Escribano Point) — Class II. East Bay (Portion in USGS Basin 12D) — Blackwater Bay (line due west from Escribano Point) southerly to Pensacola Bay (line from Garcon Point on the north to Redfish Point on the South) — Class II.

2. Santa Rosa County and Escambia County. Escambia Bay — Louisville and Nashville Railroad Trestle south to Pensacola Bay (Line from Emanuel Point east northeasterly to Garcon Point) — Class II. Pensacola Bay East of a line connecting Emanuel Point on the north to the south end of the Pensacola Bay Bridge (U.S. Highway 98) — Class II. Santa Rosa Sound — From a line connecting Gulf Breeze approach to Pensacola Beach, Bascule Bridge, and Sharp Point east to Santa Rosa/Okaloosa County line with exception of the Navarre Beach area from Channel Marker "109" to Navarre Beach — Class II.